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OF WESTERN AUSTRALIA.

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JANUARY—FEBRUARY

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The JOURNAL OF THE DEPARTMENT OF AGRICULTURE
WESTERN AUSTRALIA

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COVER PICTURE

For many years this overhead trellis carrying Ohanez vines was a well-known feature of Belhus Vineyard, Upper Swan

Since this photograph was taken, the trellis has been removed in re-planning the vineyard

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FIG. 1.—TAKING SHEEP FROM CATCHING PEN FOR SHEARING

When a sheep is taken from the catching pen, it should not be roughly handled, or allowed to become excited. Excited sheep will tend to strain and kick, making it very difficult for the shearer to maintain the correct positions for shearing. Always catch the sheep quietly, by placing the left hand under the jaw and pressing down with the right hand on the sheep's tail. When taking the sheep to the shearing stand it is preferable not to lift the sheep clear of the board, as this practice only increases the work of the shearer. Allowing sheep to remain in contact with the board is less likely to disturb them than carrying them from the catching pen.

SHEEP SHEARING TECHNIQUE

By W. L. McGARRY, Officer-in-Charge, Sheep and Wool Section; D. A. YOUNG, Shearing Instructor, and M. BUTLER, Sheep and Wool Instructor

THE shearer is an important link in the chain of operations that places our greatest export commodity—wool—before the world's buyers for valuation and purchase. It is equally true that good shearing makes a significant contribution towards more profitable sheep and wool production.

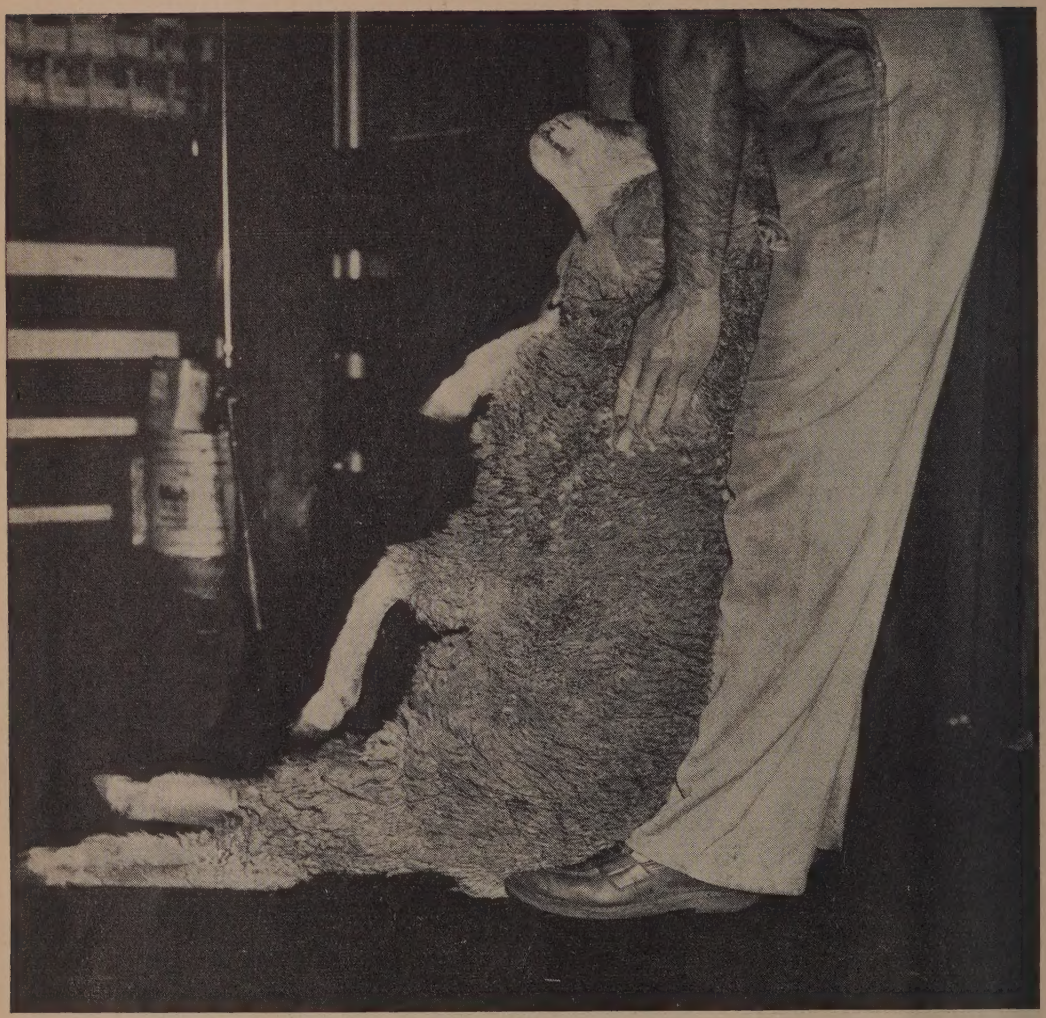


Fig. 2.—POSITION FOR REMOVAL OF BELLY WOOL
(Showing position of shearer's feet)

As the sheep is brought into position for the commencement of shearing, the belly of the sheep should be in line with the downtube and sufficiently distant from it to allow the shearer to work comfortably. The shearer's feet are close into the sheep's rump with the animal turned slightly outward. Turning the sheep outward slightly will allow the handpiece to be correctly placed and will also eliminate locking of the back joint.

In this illustration the shearer is about to grip the sheep with his knees.

With this in mind an attempt is made in the following article to supply that help and advice so necessary to the learner shearer, and to shearer tradesmen who are keen to reach a still higher degree of proficiency in their work.

LEARNING TO SHEAR

The main points to remember in learning to shear sheep are clean shearing; care and patience in handling the sheep; holding or "balancing" the animal in the positions for correct shearing; avoid-

Fig. 3.—SHEEP IN POSITION FOR REMOVAL OF BELLY WOOL
(Front view)

Showing how the sheep is held for the removal of the belly wool. Gripping the sheep between his knees the shearer has the sheep positioned and the belly nicely rounded to commence shearing the belly wool. It can be seen that the shearer holds the sheep with his knees and left hand as he reaches for the handpiece to commence shearing, also that the sheep is slightly turned away to enable the belly wool to be shorn without undue effort.

ance of second cuts, and skin cuts; a thorough understanding of the handpiece and tools, and above all a genuine desire to become a good shearer.

It is quite wrong to assume that speed is the first consideration in shearing sheep. Invariably, the best shearers are those who have taken the time to learn properly, have developed a good style and who have learned to "position" the sheep for ease of shearing, thereby eliminating waste effort and, at the same time, have acquired a knowledge of how to maintain their handpiece, combs and cutters in perfect working condition at all times; all of which is most necessary before

Fig. 4.—STARTING TO REMOVE THE BELLY WOOL

In making the first blow to open up the belly wool, the shearer's left hand parts the wool exposing the area of bare skin where a start is made. This blow is made straight down the belly, finishing at the flank, breaking out the wool at the same time. When making this blow the handpiece is gripped well back to give better control and longer reach.

sheep can be shorn at a fast pace without undue strain on the shearer, damage to the fleece, or possible injury to the sheep.

Taking these points singly, clean shearing is of paramount importance. Nothing looks worse than a pen of badly-shorn sheep, with ridges of wool showing, sweat-locks adhering to the lower parts of the body, and wool left under the jaw or on the neck which is most noticeable as sheep are being counted out.

The ability to shear sheep cleanly, and without ridging or second-cutting the wool, can only be achieved by learning to

Fig. 5.—COMPLETION OF FIRST BLOW ON BELLY
(Shearer breaking out the wool)

At the completion of the first blow on the belly the wool is broken out by turning the handpiece to the left. This movement breaks the wool cleanly without running out of the wool and cutting through the staple. The remaining wool on the belly is then shorn with cross blows.

use the handpiece in the proper manner. Ridging, or "weather-board" shearing, as it is known, is brought about by shearing with the lower, or right hand tooth of the comb raised off the skin, then making the following blow with the top, or

Fig. 6.—THIRD BLOW ABOVE CENTRE OF BELLY

The third blow on the belly is made in an upward manner, which has the advantage of safeguarding the pizzle in wethers and rams, by shearing with it rather than against it as would occur in downward blows. Note the sheep being held in control by the shearer's left arm, which also controls the sheep's right foreleg.

left hand, tooth close to the skin. When this is done it will be necessary to make second cuts, which lose time, and reduce the value of the wool.

In order to avoid leaving ridges of wool on the shorn sheep, attention must be paid to keeping the lower tooth of the comb on the skin at all times.

Care in handling sheep, both in the catching pen and on the board, is essential to good shearing, as sheep that are roughly handled become excited and will tend to strain and kick while being shorn, greatly increasing the work of the shearer in restraining the animal. Positioning or "balancing" the sheep is an important

Fig. 7.—LAST BLOW AT COMPLETION OF BELLY

Completing the belly, the wool is broken off and laid to one side. At this stage the shearer allows the sheep to lie slightly back and applying pressure with the left arm, spreads the sheep's hind legs in preparation for shearing the crutch. Gripping the handpiece well back, the shearer's reach is extended in readiness for shearing the wool in the crutch.

part of shearing; if you watch a good shearer at work, you will observe that the sheep is always in the correct position for easy entry of the handpiece into the wool, and unless it is, it will not be possible to shear properly.

Positioning the sheep, is to balance the animal allowing it to carry its own weight and moving it to the desired positions, mainly with the shearer's knees, the shearer never carrying any of the sheep's weight. Good positioning allows the shearer's left hand full freedom for use where best required and, in addition, the sheep will be less inclined to strain against the shearer.

Second cuts are costly to growers, and a loss of time to the shearer by having to

Fig. 8.—THE FIRST BLOW OUT ON RIGHT HINDLEG

It will be noticed that the shearer has changed his position slightly. By placing his left hand on the leg joint, the sheep's leg is held in control while the wool is shorn outward on the upper inside of the leg. The advantage of gripping the handpiece well back is now apparent as it enables the shearer to extend his reach.

shear twice in the same place. The more this can be avoided, the more sheep he will be capable of shearing in the day and the better will be his style of shearing. An effective method of gaining a good style when learning to shear is to count the blows taken to shear a sheep, then endeavour to lessen the number of blows taken. This will encourage the learner to fill the comb, also to make full use of each blow and is most helpful in developing a good style of shearing which not only increases the tally but also satisfies the flock owner.

A lack of knowledge of the handpiece, combs and cutters, etc., is a great disadvantage when shearing. The handpiece would only need to be slightly out of adjustment to cause the comb and cutter to pull at the wool and cause pain to the

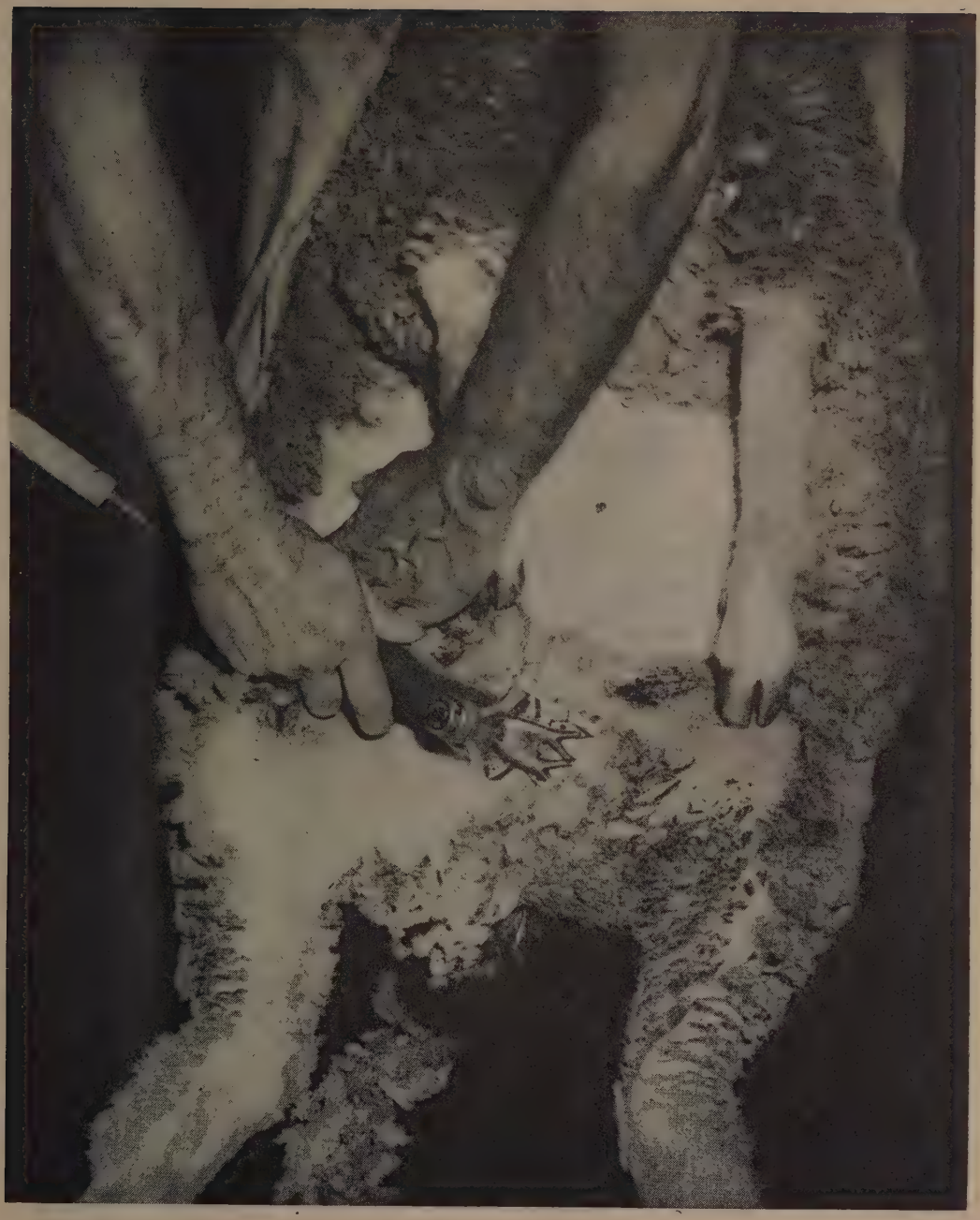


Fig. 9.—SHEARING THE CRUTCH

After shearing the wool, with outward blows, inside the sheep's right hind leg, the handpiece is turned to shear back and around inside the crutch, the shearer still continuing to control the right leg of the sheep by using pressure in the flank until the wool is shorn from under the teats. As this point is reached the shearer places the right foreleg of the sheep behind his right knee in readiness for shearing out inside the sheep's left hind leg.

Fig. 10.—ALTERED POSITION FOR COMPLETING CRUTCH AND SHEARING INSIDE THE HIND LEG

In altering his position for completing the crutch the shearer has moved his body towards the right side of the sheep. With its foreleg between his own legs the shearer retains complete control of the animal by allowing it to lay against his legs. This action brings the sheep into the correct position for completing the crutch and shearing the left hind leg. How the sheep's leg is controlled by the shearer's left hand is clearly illustrated.

sheep which will then kick and struggle out of position making it impossible to shear correctly.

Observe a good shearer at work, you will rarely see a sheep make the slightest attempt to kick or strain. This is because his machine is at all times cutting sweetly and causing no discomfort to the animal, which, as a consequence, can be shorn without undue effort. Speed in shearing is not learnt but comes naturally with the ability to absorb and co-ordinate all the time and labour-saving points in shearing, and is attained by practice, which eventually becomes habit. Remember, good habits are better than bad ones!

With machine shearing the sheep must, at all times, be within the range of the machine, as the handpiece cannot be made to reach sheep that are out of posi-

Fig. 11.—MAKING THE FIRST BLOW BACK TO SHEAR THE LEFT HIND LEG

To shear the left hind leg the shearer retains his pressure with his left hand on the flank, as illustrated in Fig. 10, until a blow is made outward over the top of the leg. This blow is made outward to enable easy entry of the handpiece into the wool as it is turned to shear back along the leg. Making the first blow back to level with the flank the shearer relaxes the pressure and rolls the wool back with his left hand. In this manner he is able to avoid cutting the animal and also exposes the flank. The wool is then shorn from the hind leg back as far as the tail, shearing back along the leg.

tion. Consequently, attention must be paid to turning the sheep to suit the machine if ease in shearing is to be acquired.

This can only be brought about by correct placing of the sheep at the start and maintaining the proper positions from start to finish while the sheep is being shorn.

In the following pages the various positions in which the sheep are balanced and the manner in which the blows are made are fully explained in the order in which they take place.

COMBS AND CUTTERS

The choice of combs and cutters is sometimes a difficult problem for the learner shearer. Frequently the question is asked which is the best type of comb to use. The answer is, the best combs to use are the ones you accustom yourself to using with good results.

Fig. 12.—COMPLETION OF THE FIRST HIND LEG, SHOWING REVERSE BLOW

To shear over the tail, a reverse blow is made. Making this reverse blow over the tail eliminates any danger of picking up the skin with the points of the comb. Shearing over the tail in this position is preferable to pulling up the sheep in an effort to complete the last few blows at the finish which is a strain on the shearer as well as a loss of time and carries the risk of damaging the vulva. A well-shorn crutch and tail is an effective measure against blowfly strike. Before moving from this position the wool on the topknot is removed.

There are a number of shearing combs of different make on sale, all of which conform to standard pattern and width, 2½ inches, Australian conditions.

Whilst there are slight variations in the pattern of combs of different make, they will all give satisfactory performance until worn out. The learner's problem can therefore be overcome by selecting the type of comb he likes and continuing to use that particular type to the exclusion of all others. The degree of skill attained by the shearer is due to his own adaptability and to becoming thoroughly accustomed to the tools he selects.

It is not good practice to use several different types of combs during shearing, as this prevents the shearer from becoming used to one type.

When purchasing shearing combs and cutters, be careful to select the cutters that are made to match the comb. The use of unmatched combs and cutters is NOT recommended as this practice reduces

Fig. 13.—FIRST BLOW, OPENING UP THE NECK

From position 12, the shearer has moved the sheep into position for shearing up the gullet. To achieve this position, which enables the shearer to hold the sheep firmly between his knees, it is necessary to bring the sheep back into a sitting position; at the same time, stepping the left leg well around the sheep's body, following this movement by placing the shearer's right foot in the crutch, making sure the knee grip in the brisket is not at any time relaxed. This alteration in position, if correctly carried out, allows the sheep to be properly balanced and held comfortably between the shearer's legs.

A close study of this illustration will show that the shearer's left foot has been placed well around the sheep. By placing the foot well around the sheep the shearer is able to achieve good control and balance which enables him to lightly hold the sheep's jaw in position for opening up the neck. Holding the sheep's jaw lightly when shearing up the neck will reduce the animal's tendency to kick or strain against the shearer. Notice the sheep's right foreleg is securely held in a locked position by the shearer's right leg.

the handpiece's ability to cut the wool cleanly. The cutters must at all times be maintained at even thickness to ensure that the post setting of the handpiece will be correct for all cutters when adjustments are made to the centre post. Adjustments to the centre post are necessary from time to time to compensate for wear on the cutters caused by frequent grinding. How these adjustments are made, is fully explained in Leaflet No. 1075 "Aids to Better Shearing" which deals with handpiece maintenance and grinding, and can be obtained free on application to the Department of Agriculture, Perth.

Before putting new combs into use, it is advisable to test the points for "prickiness" by drawing the comb points across the palm of the hand. Some combs even

Fig. 14.—After shearing the wool from the gullet and face of the sheep, the animal's left ear is held by the shearer while the wool is shorn from behind the ear and the horn prior to shearing the shoulder.

When shearing the shoulder, very little alteration is made to the position of the sheep or shearer other than to move the left knee slightly back to allow the sheep to maintain a round shoulder surface. At the same time, the shearer's left elbow is used to control the head of the sheep, and his arm for tightening the skin of the shoulder while he continues to make the blows in an upward manner until that part is shorn.

when new are found to be pricky on the points and will need to be smoothed off before using, otherwise they tend to pick up the skin. Stropping the points of a comb that exhibits signs of being pricky will smooth the points ready for use.

When combs are worn out and become pricky they should be replaced. Continuing to use combs that are obviously worn out will increase the danger of injuring sheep and cause the shearer to lose confidence in his ability as a tradesman.

Fig. 15.—SHEARING THE SHOULDER AND LEFT FOREARM

After shearing the shoulder wool, the sheep's left forearm is next shorn. This is done by holding the foreleg outward, not upward, and shearing from the knee joint back along the forearm. Holding the foreleg outward the wool can be shorn with less risk of cutting the skin, and fuller use of the comb. Shearing the lower shoulder and forearm the sheep is held in a balanced position by the shearer's elbow holding the sheep against his left knee, while keeping the opposite foreleg securely locked behind his right leg.

The remaining wool on the shank is removed, before turning the sheep into position for the long blow, by gripping the shoulder joint and straightening the leg, shearing outward on the inside and back on the outside.

Fig. 16.—This side view of Fig. 15 clearly shows the position of both sheep and shearer and illustrates how the sheep is balanced in a nicely rounded position for shearing the shoulder and foreleg.

Fig. 17.—SHEARING THE LONG BLOW

In preparing to shear the long blow, a complete alteration is made in position. In making this alteration the shearer still maintains the sheep in a sitting position as he turns it to face in the opposite direction, shearing out any wool left on the brisket as he does so, then allows it to slide down his left leg on to its back, control being maintained by keeping the left foot well under the animal's shoulder. This is essential if proper balance and control is to be achieved. The sheep should not be allowed to lie flat on its side, but kept in a balanced position, the right foreleg securely locked behind the shearer's left leg. Starting at the flank, the wool is shorn from the side and over the backbone with blows made parallel with the backbone.

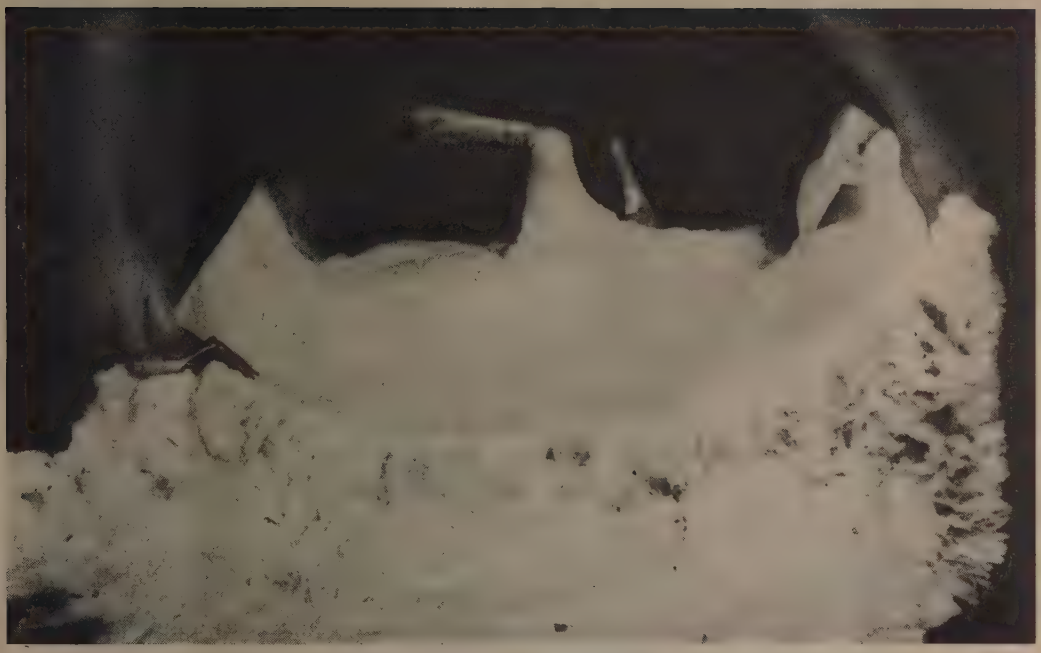


Fig. 18.—A FURTHER STAGE IN SHEARING THE LONG BLOW

Prior to reaching the backbone, it will be necessary for the shearer to change the position of his right foot from between the sheep's hind legs to the outside of the animal. Note that the shearer does not kneel on the sheep.

Fig. 19.—SHEARING OVER THE BACK OF THE NECK

Shearing one blow over the backbone, the blow is continued up the back of the neck and around over the ear and face.

Fig. 20.—SHEARING OVER THE HEAD AND NECK OF SHEEP

Shearing over the head, prior to shearing down the neck; the blows are made, starting below the ear and shearing towards the brisket point, continuing the blows until the neck is shorn, taking most of the weight on the shearer's left leg.

Shearing this part both forelegs of the sheep must be securely held behind the shearer's left leg, otherwise complete control is impossible. Note that the shearer has not dragged his foot through the fleece.

Fig. 21.—A front view of figure 20, showing how the sheep is controlled by the shearer's left foot as the face wool is shorn.

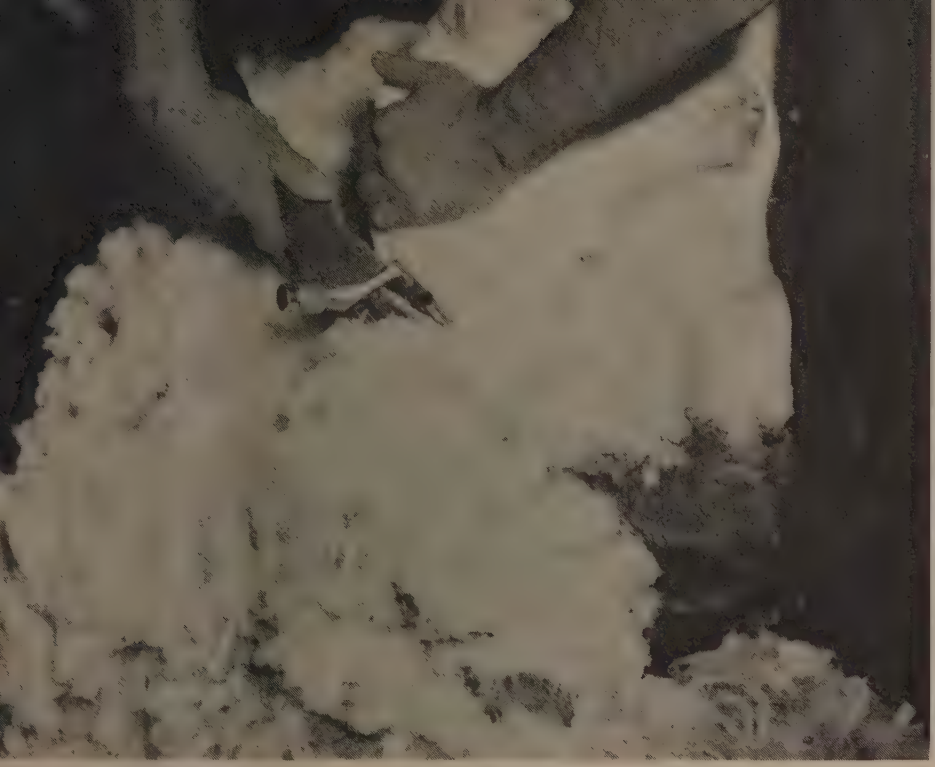


Fig. 22.—COMPLETION OF THE NECK IN PREPARATION FOR SHEARING THE SHOULDER

At this point the shearer presses down on the head, not pulling it upwards, which is the natural tendency. This pressure on the sheep's head, in combination with the locking grip maintained by the shearer's left foot, rolls the sheep backwards and upwards into a sitting position.

Fig. 23.—SHEARING THE SHOULDER

Notice the method of holding the sheep to shear this portion which is shorn by using blows made in a curving manner to below the shoulder blade. The sheep is in the right position and is very easily controlled by the shearer's left heel and hand.

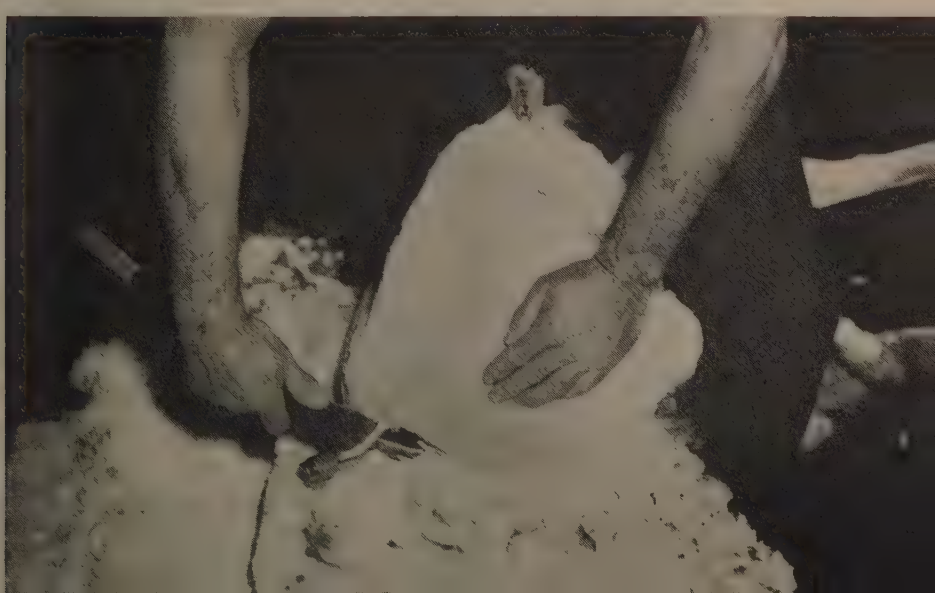


Fig. 24.—SHEARING THE RIGHT FORELEG

Shearing on past the shoulder-blade and before releasing the foreleg, a short blow is made outward on the foreleg to remove the wool from the shoulder joint. This blow is essential in order to avoid severing the shoulder vein when shearing the right foreleg and is made as the shearer is about to release the foreleg. How control of the animal is maintained by the shearer's heel can be seen in the above illustration.

Fig. 25.—SHEARING BELOW THE RIGHT FORELEG

At this stage the shearer momentarily relaxes his leg grip, releasing the foreleg, which he then holds outwards until another blow is made along the leg. Picking up the foreleg, he commences to shear downward, curving his blows and shearing across under the armpit. By continuing to shear downwards the shearer would certainly cut the skin as it puckers under the armpit, therefore crossblows are used, as shown, to ensure that the animal is not cut at this point.

Fig. 26.—SHOULDER COMPLETED, STARTING LAST SIDE

With the shoulder wool shorn, a start is made on the last, or "whipping" side. From this point the sheep is gradually brought back into a sitting position.

Fig. 27.—THE "WHIPPING" SIDE

Bringing the sheep upwards to a balanced position, the shearer is now at a point where it will be necessary to change his stance by lifting his left foot over the hind legs of the sheep and placing it close up under the rump, at the same time bringing its head up from between his legs.

Fig. 28.—THE "WHIPPING" SIDE

The shearer has now changed position to complete the last side. In making this change, he has stepped his left foot over the sheep's hindlegs to a position behind the sheep and brought the animal's head up on to his lap. Placing his feet close up under the rump of the sheep, the shearer presses out with his knees curving the sheep's body to obviate wrinkling or picking up the loose skin with the teeth of the comb. In this position the blows are made more in a downward direction than crosswise.

Fig. 29.—As the last side is being shorn, greater control is secured by placing the left elbow on the point of the shoulder and exerting a light pressure which prevents the animal from leaning forward and straining. It also brings the body of the sheep into a good easy position for shearing that part.

Fig. 30.—CLEANING THE FLANK

When the flank is reached, the shearer rolls the wool downwards with his left hand in preparation for shearing out that part of the wool that would otherwise be difficult to shear. This movement also allows the blow to be continued out along the leg.

Fig. 31.—HOW THE HIND LEG IS CONTROLLED BY THE LEFT HAND

By placing the left hand in the sheep's flank and moving back slightly, complete control is gained when finishing off the hind leg. Reasonable pressure at this point, controls and brings the leg into a position where the shearer can reach to its full length. This pressure in the flank maintains the leg in a straightened position, eliminating the danger of severing the hamstring.

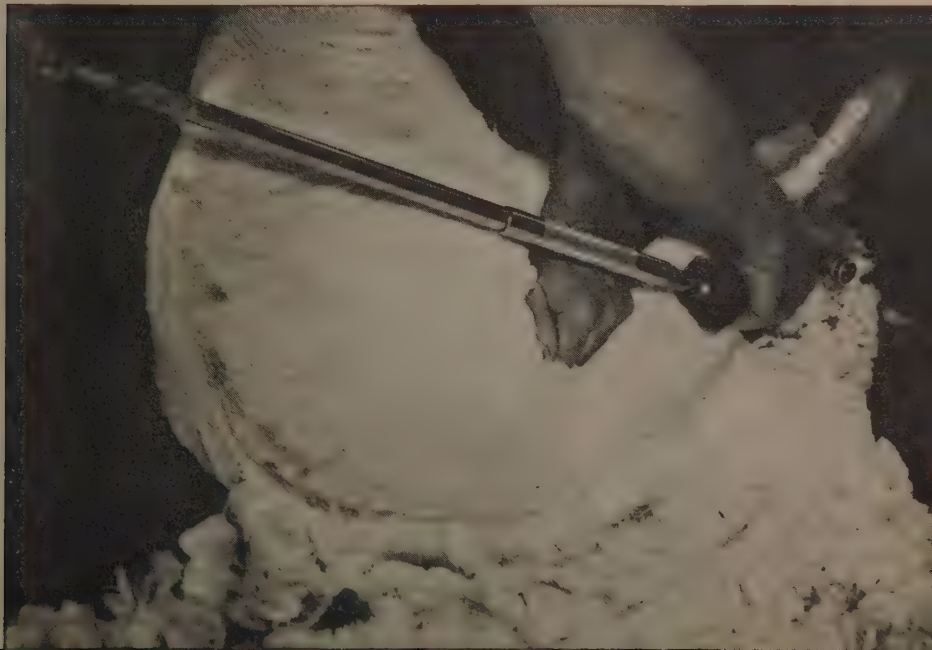


Fig. 32.—THE FINISHING BLOW

In finishing off, the sheep's leg is pressed down, not pulled up. The shearer's leg is now between the sheep's forelegs, which allows the animal to take its own weight. This picture shows where the finishing blows are made, on the rump, and not on the tail.

Fig. 33.—This photograph clearly shows the position of the sheep and where the finishing blow is made.

Fig. 34.—LETTING GO

Having completed the sheep, the machine is first pulled out of gear before any attempt is made to release the sheep. This practice will assist the shearer by allowing him full use of his two hands in directing the sheep into the chute, thus avoiding the danger of the sheep becoming entangled in the wool. It is also good practice to have the machine stopped while not actually shearing as free running quickly dulls the edges of both the comb and cutter.

Fig. 35.—CORRECT METHOD OF RELEASING SHEEP.

Notice how the sheep is kept clear of the fleece as it is directed into the chute through the shearer's legs. The wool is left undisturbed and can be easily picked up in one piece, which simplifies the work of the woolroller.

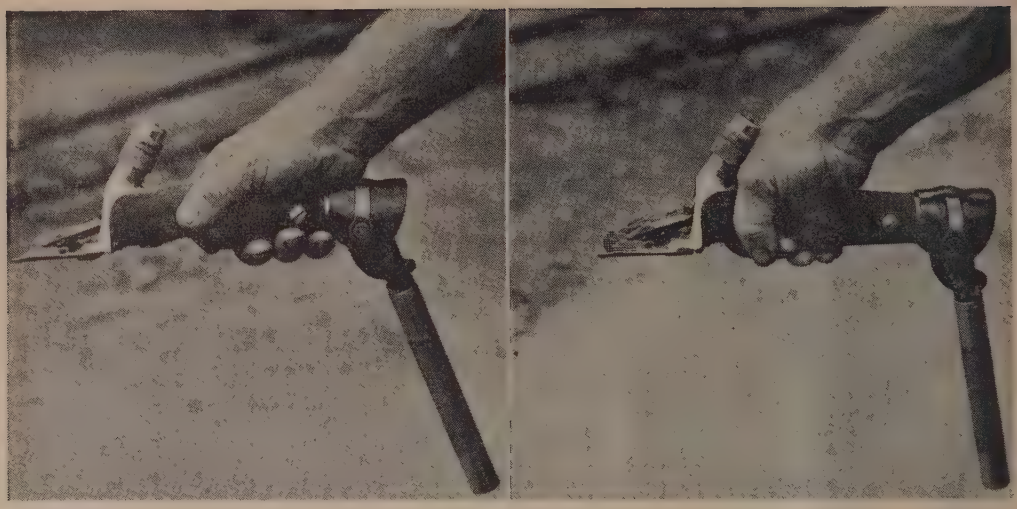


Fig. 36.—THE HANDPIECE GRIP—CORRECT AND INCORRECT

The method in which the handpiece is held, is an important factor in sheep-shearing. Should the handpiece be held incorrectly, it is difficult to place the comb in the desired positions. Illustrated above is the correct (left) and incorrect (right) method of gripping the handpiece. Dealing with the correct grip, which is well back on the barrel of the handpiece, it becomes obvious that the shearer has greater control and better balance of his machine, a more extended reach, together with a freer wrist movement, which is a vital factor in shearing. Using the index finger and thumb more as a guide, the handpiece is held mainly by the remaining three fingers. Holding the handpiece in this manner the shearer has freedom to allow his machine to spin or turn in his hand for shearing certain parts of the sheep, such as the inner sides of the hind legs, the reverse blow on the tail, etc. Allowing the handpiece to turn with the drive for shearing these parts is a definite advantage to the shearer.

In the right-hand photograph, the handpiece is held incorrectly, with the thumb and fingers encircling it close up to the tension nut. This is a fault all too prevalent with learner shearers, and greatly restricts the wrist movement, causing undue strain on the muscles of the forearm. The reach is shortened, and the machine is unbalanced with less control, which tends to bad shearing, also any heat developed by friction in the handpiece is usually at its maximum at the tension nut which causes much discomfort to the shearer. Another disadvantage of this type of grip is that the wool is not cut sufficiently far ahead of the shearer's hand to achieve a free, flowing style.

CORRECTION

On page 673 of our November-December issue, an advertisement was published on behalf of Lysaght's Works Pty. Ltd., Newcastle, which featured the Company's range of prefabricated Water Tanks. Inadvertently the incorrect prices were shown, which should read as follows:—

PRICES EX FREMANTLE STORE

Nominal Capacity	Diameter	Height	Weight	Price
25,000 gallons	23ft. 10in.	10ft. 4in.	1¾ tons	£329
50,000 gallons	33ft. 5in.	10ft. 4in.	2½ tons	£460
75,000 gallons	40ft. 7in.	10ft. 4in.	2¾ tons	£577
100,000 gallons	45ft. 9in.	10ft. 4in.	3¼ tons	£656

Prices c.i.f. capital cities available on application

10,000-Gallon Water Tanks (tall or squat) are available also

10,000-GALLON WATER TANK PRICES EX FREMANTLE STORE

14ft. 4in. dia., 10ft. 7in. high. Basic unit, £135

19ft. 1in. dia., 6ft. 5in. high. Basic unit, £102

This advertisement is published again in our current issue on page 19

ANT-PROOFING THE APIARY

By S. R. CHAMBERS,
Field Assistant,
Apiculture Section

Fig. 1.—Simply-made pressure chamber for fumigating ant nests

DURING the warmer months the infiltration of ants into an apiary can provide the beekeeper with some serious problems. At a time when his thoughts should be on extraction and honey crop problems, the hive-owner is little interested in studying the habits of various attacking ants, and cannot afford to waste valuable time in devising methods of ant eradication.

The normal reaction being to look for the cheapest and quickest way out, encourages the thought of moving the bees on to another site. For a migratory apiarist, this may be the obvious solution but there are many beekeepers today who are establishing permanent sites within their own properties.

A queen breeder, may require a permanent breeding apiary site, or the orchardist a permanent apiary for experiments on insect pollination. Neither the small mixed farmer developing a honey sales sideline, nor the backyard beekeeper are in the position to change their bee sites at will, and many commercial apiarists can ill afford to move at short notice because of ant invasions.

It is intended herein to discuss some of the many anti-ant measures seen used in the field. No individual method of ant prevention is necessarily recommended as it will be understood that measures may differ according to type of country and the ant species involved. It remains for the beekeeper to achieve control by trial and error.

On some occasions it is sufficient to raise the hives off the ground by placing stones or rocks under the bottom boards. Strong colonies will often resist attack by ants if suitably protected, but weak colonies may soon succumb to the invaders.

Fig. 2.—Hive resting on four bottles with necks downward

Probably the most effective action for the eradication of ants in the apiary is to move the hives a little farther away than bee-flying distance of one and a half miles; spray the desired apiary area on a grid system, with one of the commercial insecticides and then, after seven days or more, return the bees to the original site. Attention to individual ant

Fig. 3.—Hive on bottles laid horizontally

Fig. 4.—An old motor-tyre often makes an effective hive-stand. Many ants dislike traversing rubber surfaces

nests within the apiary area from then on will keep the problem down to a minimum.

FUMIGATION AND POISONING

Where ant nests are prominent and not too numerous to treat, a hole may be made in the centre of the nest, a little carbon-bisulphide CS2, sheep dip or cyanogas applied and the hole covered in. These three materials must be used with caution. CS2 is most dangerous as it is very inflammable; sheep dip is a poison that should be handled with respect, and as cyanogas is intensely poisonous it must be used with utmost care.

A very effective and simply-made gadget used in the fight against ant infestation is what may be described as the poison smoke pressure chamber. (See Fig. 1.) It is made up by soldering a truck-tube valve into the bottom of a one gallon cylindrical tin. The top of the tin is cut out leaving a clean edge on the perimeter. A car pump is attached to the valve, and one of the insecticidal smoke generators is lit and placed under the tin, which in turn is placed over one of the well established ant nest holes and pressed down.

Fig. 5.—A hive-stand of this nature provides too many pathways for invading ants to use

By applying air pressure to the cylinder, the insecticide smoke is forced to follow the ant tunnels leaving a residual of insecticide on all surfaces with which it makes contact. In heavy ground it is claimed that the smoke may be seen faintly issuing out of other nests connected by tunnels over an eight foot radius. On sandy soils, it is less effective but is well worth a trial.

A further precaution in discouraging ants from nesting beneath the hives is suggested by some beekeepers who recommend painting the undersurface of the bottom boards with creosote or one of the commercial tyre paints. This helps greatly

Fig. .6—A portable timber hive-stand fitted with galvanised iron ant-caps

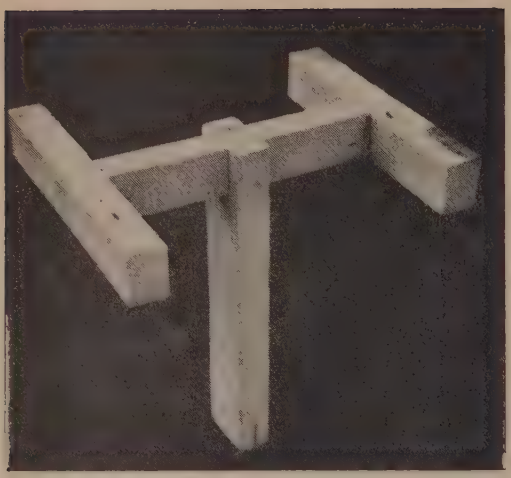


Fig. 7.—"Floating H" hive-stand

in keeping the undersides of hives fairly free of most troublesome insects. It is not wise to paint too close to the alighting board as the bees may be roused to the extent of absconding.

It is claimed that the use of bottles to stand hives on is in many cases very effective. The bottles are either placed flat or are worked neck first into the ground. (See Figs. 2 and 3.) With the bottom board placed on top of the bottles the hive is raised above ground level which also helps to prevent white ants from attacking the timber.

An old motor car tyre used as a stand will often hinder the ants from gaining access to a hive as a peculiarity of some ant species is that they obect to passing over a rubber surface. (See Fig. 4.) As rubber burns with intense heat it is unwise to use such stands in districts subject to bush fires.

Some apiarists build permanent hive-stands fitted with ant capping and/or oil baths to act as ant barriers. Care should be taken not to make these too elaborate as superfluous timber costs money, takes time to fit and often provides extra pathways for the invading ants (see Figs. 5 and 6).

Long hive-stands save construction time and timber as they can carry several hives, but they add to the difficulty of manipulating the hives and over the years they are apt to become a barrier to complete efficiency. If long stands are used, it should be remembered that the individual hives should be about six feet apart.

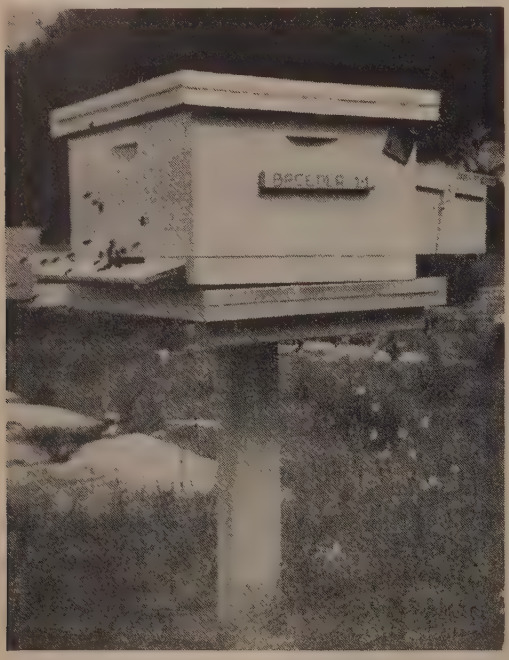


Fig. 8.—"Floating H" hive-stand in use

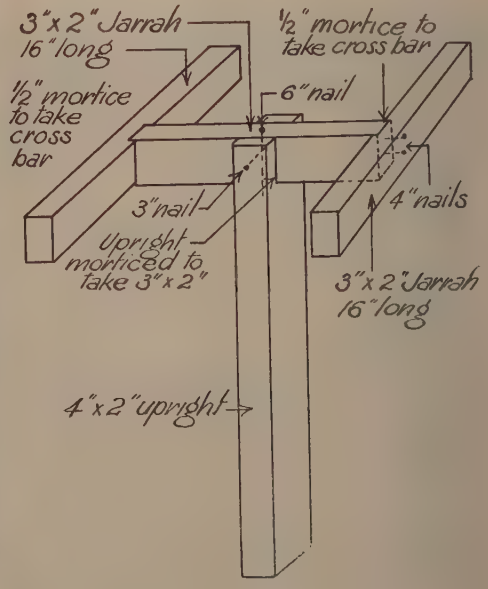


Fig. 9.—Constructional details of the "Floating H" stand

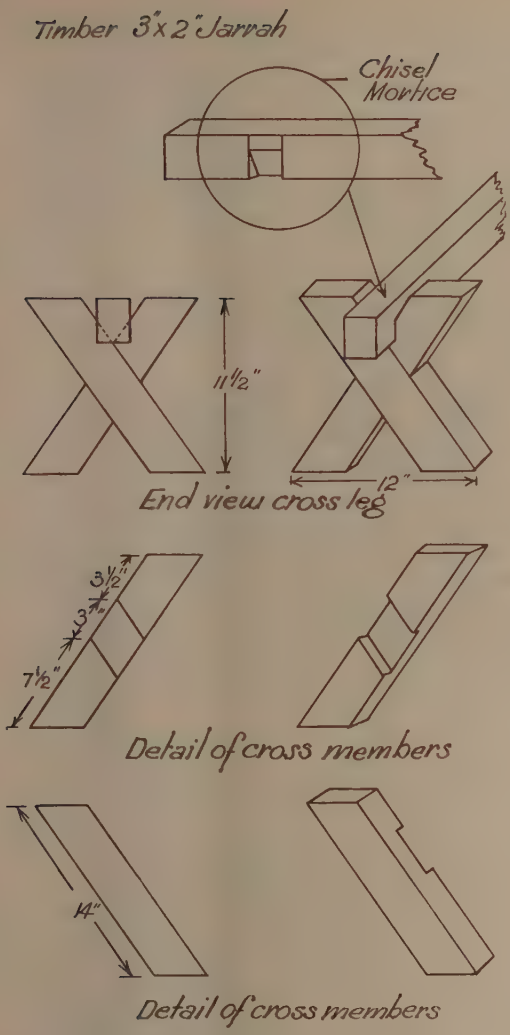


Fig. 10.—Constructional details of the angle-legged hive-stand

Whether for the large-scale commercial apiarist, the orchardist or the backyard beekeeper, the individual single-hive stands are undoubtedly the best in the long run.

They allow the hives to be approached easily from any angle and provide no obstructions for the busy apiarist. Whether designed as permanent fixtures or as movable stands, they have many advantages and although the initial costs for material and labour may be higher than those for the multiple-hive stands their ease of handling makes for comfort and efficiency.

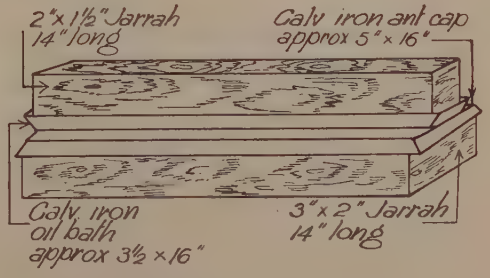
The "Floating H" stand (see Figs. 7, 8 and 9) is a deservedly popular pattern. It is simple to construct and lends itself to mass production. Its main feature is that it has only a single support to provide an approach for the ants. By occasionally spraying the base of the upright with a commercial ant spray, or even painting it frequently with sump oil, the ants are kept at bay.

The angle-legged stand shown in Fig. 10 is designed as a collapsible unit and consists of ten separate straight timbers in the flat. The length is optional but we prefer the single-hive stand. Nails are not required in assembling as the joints fit tighter as the weight on the cross-members is increased.

There is an infinite variety of hive-stands and many incorporate ant-caps and/or oil baths to serve as ant barriers.

An effective low stand is shown in Fig. 11. It consists of a 14in length of 3in. x 2in. jarrah surmounted by an ant-cap made from a rectangle of galvanised iron approximately 16in. x 5in.

Resting upon this is a shallow trough made from another piece of galvanised iron approximately 16in x 3½in. This carries the oil and a 14in. length of 2in. x 1½ in. jarrah. Neither the ant-cap nor the oil-bath need be soldered, being simply bent to shape and the corners crimped or folded.



A simple hive stand incorporating the ant cap and oil bath principles.

Fig. 11.—An effective low-level stand

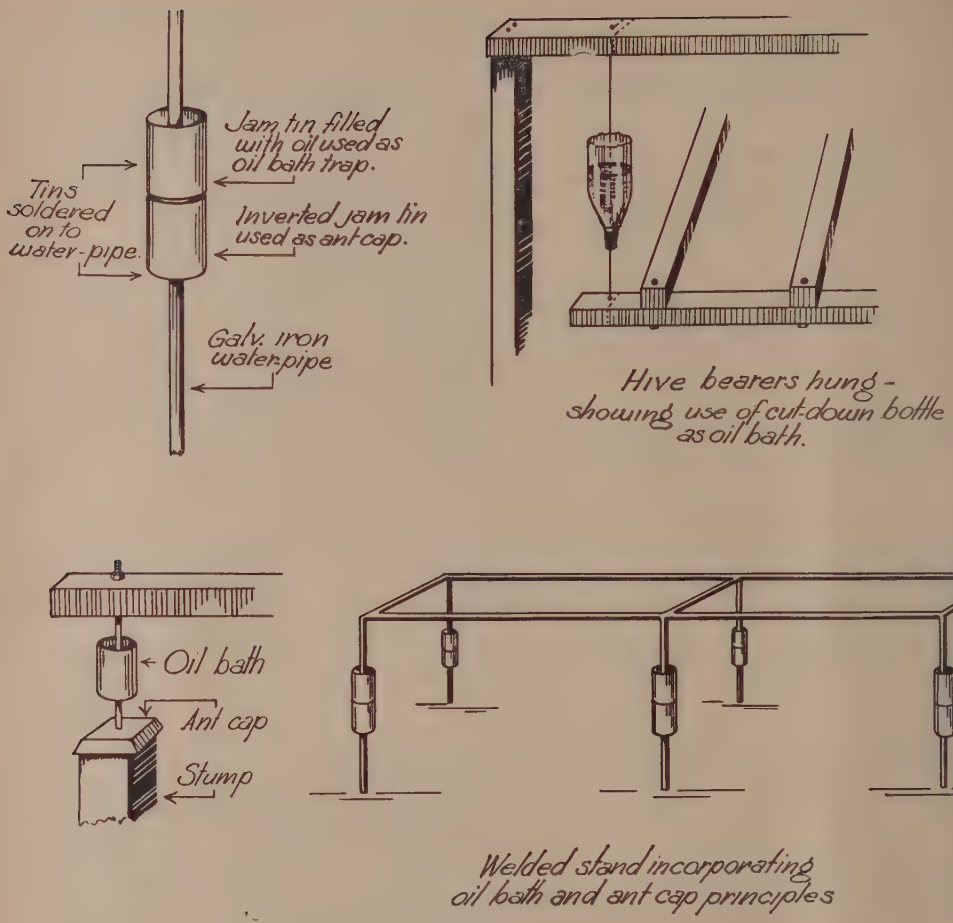

Jam tin filled with oil used as oil bath trap.
Tins soldered on to water-pipe.
Inverted jam tin used as ant-cap.
Galv. iron water-pipe
Hive bearers hung - showing use of cut-down bottle as oil bath.
Oil bath
Ant cap
Stump
Welded stand incorporating oil bath and ant cap principles

Fig. 12.—Some common types of ant-proof hive-stands

Two of these stands are used for each hive, although if desired, they could carry cross-bars to accommodate two or more hives.

Fig. 12 shows different types of ant-proof stands. Jam-tins soldered on to galvanised water pipe are used as ant-caps or oil baths, in some patterns, and cut-down bottles serve as oil-containers for hive bearers suspended on wires.

To cut the bottoms off bottles, bend thick wire or round iron into a circle that fits snugly over the bottom of the bottles, leaving a long handle. Heat the wire to red heat and place it over the base of the bottle for a few seconds, then remove the wire and plunge the bottle into cold water. It will crack round the heated portion and if the sharp edges are smoothed with an old file the bottles may be handled safely.

The wire passes through a tightly-fitting cork.

GENERAL PRECAUTIONS

Keeping the apiary site clean and free from grass and rubbish will help in controlling ants as well as safeguarding the hives against fire risks.

Ant nests in the vicinity of the apiary should be treated regularly by poisoning or fumigating and it is a good idea to keep a bottle of prepared insecticide close at hand so that any ant colonies known to be active may be treated immediately.

REVISED GRADE HERD RECORDING RULES

By M. CULLITY, B.Sc. (Agric.), Superintendent of Dairying

THE rules governing the operation of Grade Herd Recording under the Western Australian Herd Improvement Scheme were recently revised and modified to meet existing conditions.

The revised rules are published for the information and guidance of interested dairy farmers.

GRADE HERD RECORDING—WESTERN AUSTRALIAN HERD IMPROVEMENT SCHEME

RULES

1. The scheme shall be known as the Western Australian Herd Improvement Scheme and will be under the control of the Superintendent of Dairying, Department of Agriculture.

2. The State shall be considered as one Grade Herd Recording Association and units within the Association may be formed in suitable centres in the dairying districts and each unit shall be compact in area. Each unit and each herd within the unit shall be given a letter for identification and recording purposes.

3. Dairy farmers who desire to join a unit and become members of the scheme are required to make application annually by February 15, of each year on G.H.R. Form 2 (Application Form for Herd Testing). A farmer may apply for membership of a unit at any time within a testing year.

4. The official herd recording year shall cover the period from March 1, to the following February 28. New units may be formed to commence testing at any period between March 1 and July 31.

5. Every member shall undertake to effect the culling from his herd of all cows which, having reached the age of six (6) years, fail to produce 175 lb. of butterfat in each of two consecutive lactation periods.

6. Each member of a unit shall undertake that within three years from entering a herd for recording he shall not use a bull unless it is a pure bred dairy bull from a cow which has achieved the production standard prescribed in the Rules of the Official Western Australian Pure Bred Herd Recording Scheme.

7. Each member shall undertake not to rear any bulls to be sold for use as sires of herds unless they are pure bred dairy bulls.

8. Each member must undertake to provide the herd recorder with satisfactory free board and lodging whilst he is on duty on the property.

9. **Facilities.**—Satisfactory facilities to enable the recorder to carry out his duties must be provided. These shall include:—

(a) A bench in the milking shed or milk room for use whilst taking samples and recording details of cows and their yields.

(b) A firm bench to carry the centrifuge during testing.

(c) Adequate supplies of hot water for testing and cleansing equipment.

(d) Adequate ventilation and lighting.

10. A member must submit for testing all cows in his milking herd and must continue testing all cows until they are dry. Such cows will be classified at the first test as being "A" class cows or "B" class cows. The records of yields for "B" class cows will not be published or used in calculating averages either for the herd or the scheme as a whole.

The following may, with the approval of the Superintendent of Dairying, be classified as "B" class cows:—

(i) Cows which have aborted.

(ii) Sick cows.

(iii) Cows with permanently diseased or damaged udders or which milk from less than four quarters.

Cows in categories (i) (ii) and (iii) above automatically become "A" class cows if they produce 150 lb. of fat in the first six months of their lactation period.

(iv) Nominated cows. A nominated cow is one which has calved normally but which on entering test is nominated for culling. If such cow is not out of a herd six months after calving she shall automatically become an "A" class cow.

(v) Strippers. A stripper is defined as a cow which has already completed a full lactation period and has not again freshened or, in a herd entering test for the first time, a cow which has calved more than 150 days prior to the first test. Such cows shall remain "B" class cows for the remainder of that lactation.

11. (a) **Fees.**—The fee for an "A" class cow per lactation period shall be prescribed annually and the minimum subscription shall be equal to the testing fee for ten (10) cows. There will be no charge for testing "B" class cows. The full fee as prescribed each year shall be paid on the estimated number of "A" class cows to commence a lactation period by October 31 each year.

When any variation occurs between the estimated and the actual number tested, the fee shall be adjusted annually.

The fee for cows purchased after or calving after October 31 each year shall be paid as soon as the cow is tested.

(b) **Method of Payment of Fees.**—The recording fee shall be paid on application for the testing of a herd. Where, however, this is not possible, the fee shall be secured by an irrevocable procuration order on a dairy company. For the purpose of assessing fees every cow which has been tested once shall be deemed to be a cow submitted for test.

Fees will not be refunded to a member after the first test of his herd has been carried out.

12. **Identification of Cows under Test.**—The herd recorder shall be supplied with the following details of each cow in each member's herd:—

Age.
Colour.
Marks and/or brands.
Date of calving.
Sex of last calf, and also the pedigree to the extent known.

The following means may be adopted to identify the cows under test:—

(a) Members may have their cows individually marked for identification by tattooing in the right ear with two letters to indicate the unit and the herd, and in the left ear with a numeral to identify the individual cow.

(b) Where members do not require individual identification of their cows they shall, when requested by the recorder, place in the milking shed a list showing a description of all cows in the herd.

(c) Should difficulty be experienced by the recorder in recognising individual cows he may request that individual identification as in (a) be adopted, and in such case the farmer shall give assistance in so marking the cows.

(d) When cows are submitted for test bearing the number allotted in another unit, or in the case of cows purchased which already

bear an identification mark for herd book purposes, no further identification marks are necessary.

13. **Identification of Heifer Calves.**—(a) All heifer calves the progeny of cows under test and by pure bred bulls shall be marked to enable individual identification.

(b) A witnessed declaration must be given in support of calf identification. If the owner is not actually caring for the herd the declaration must be signed by the person doing this work and endorsed by the owner.

(c) The method of identification shall be as set out in Rule 12 (a) but with the addition of a letter in the left ear to indicate the season of birth as follows:—

March 1, 1956, to February 28, 1957—Letter K.
March 1, 1957, to February 28, 1958—Letter L.
March 1, 1958, to February 28, 1959—Letter M.
March 1, 1959, to February 29, 1960—Letter N.
March 1, 1960, to February 28, 1961—Letter O.
March 1, 1961, to February 28, 1962—Letter P.
March 1, 1962, to February 28, 1963—Letter Q.
March 1, 1963, to February 29, 1964—Letter R.
March 1, 1964, to February 28, 1965—Letter S.
March 1, 1965, to February 28, 1966—Letter T.

(d) The calf must be marked as soon after birth as possible, preferably on the visit of the recorder following the birth of the calf.

(e) No calf shall be marked after it reaches the age of 12 months.

14. **Sampling Procedure.**—The Herd Recorder shall weigh the milk yielded by each cow at each milking during the period of his visit and shall take fair proportionate samples of each cow's milk on two consecutive milkings. Care should be taken to eliminate froth before taking readings.

The volume of the composite sample should be between 40 cc. and 50 cc. In the case of a cow giving 10 lb. of milk at night, take 2 cc. per lb. of milk (equals 20 cc.) and 12 lb. of milk in the morning (equals 24 cc.), giving a composite sample of 44 cc. The number of cc. that has been taken from a pound of milk may be indicated by a small figure against the night's weight of milk as 10^2. The same factor shall be used when sampling the morning's milk.

At the request of the member the recorder shall give him a similar composite sample from each cow which he may keep as a check sample.

15. **Abnormal Tests.**—When a yield of butterfat during the 24 hour test period differs by more than 25 per cent. from the preceding test such test may be reported as abnormal but reasons for considering the yield abnormal shall be noted by the recorder on the day sheet. In the case of a cow testing abnormally, such tests shall be recorded but may not be used in calculating the yield for the lactation. In such case an average will be made from the proximate and succeeding tests to determine production for the sub-period. The final decision as to abnormality shall rest with the Superintendent of Dairying.

16. **Lactation Period.** — The lactation period shall be 300 days and shall consist of ten sub-periods of 30 days. Each herd shall be tested once every 30 days, but if it is not possible to make a test immediately after an interval of 30 days the test may be taken not more than 35 days nor less than 25 days after the preceding test, and if this is not practicable calculations for the sub-period concerned shall be obtained by averaging as in the case of an abnormal test (vide Rule 15).

17. No cow shall be tested unless five clear days (120 hours) have elapsed since calving, e.g. if a cow calves Saturday morning after milking time a sample cannot be taken before Thursday afternoon.

18. **Credit to be given on First Test.**—In cases where owners are commencing to test their herds for the first time or where it has been found impracticable to test certain cows until after they have calved for a period, the herd recorder is authorised, if he is satisfied regarding the date

of calving, to credit these cows with milk and butterfat production as shown hereunder; such credit to be based on the first 24 hour test made by the herd recorder:—

Number of days elapsing between calving and first test.	Period of production credited on first test (days).	Number of tests required for 300-day lactation period.	Method of arriving at the 10th sub-period.
5–44	30	10	Treat 10th test as for normal sub-period.
45–74	60	9	Treat 9th test as for 10th sub-period.
75–150	90	8	Treat 8th test as 10th sub-period.

19. **Farmer Provided with Daily Record Sheet.**—The herd recorder shall, after each testing day, leave with the member a day sheet (G.H.R. Form 4) setting out milk and butterfat production of each cow for the day, the sub-period concerned, and the progressive yield from the day of entry to test. The daily yield of butterfat shall be calculated by the following formula:—

$$\frac{\text{Daily Milk} \times \text{Test}}{100}$$

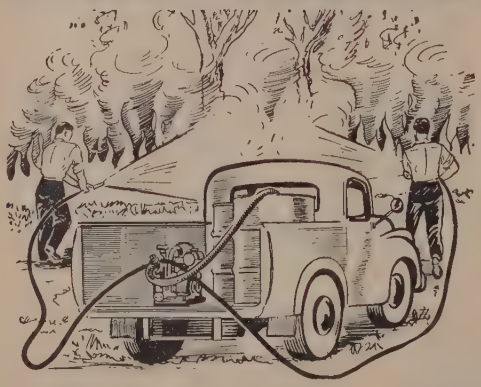
and the sub-period yield of milk and butterfat shall be 30 times the daily yield.

20. **Calculation of Averages.**—The annual average yield of a herd shall be calculated by dividing the sum of the individual complete "A" class lactation yields by the number of lactations concerned. It shall include all "A" class lactations completed during the testing year irrespective of whether they commenced prior or subsequent to the start of that year. For the purpose of recording, a complete lactation shall be between 90 days and 300 days, provided that in the case of lactations between 90 and 300 days the recorder is satisfied that the animal has dried off normally.

21. **Annual Report.**—Each member shall receive after the end of the testing year a report showing yields of the individual "A" class cows in his herd, which have completed lactation, and the average yield of the herd.

22. All members of the scheme must abide by these Rules.

FIRE HAZARDS SEVERE



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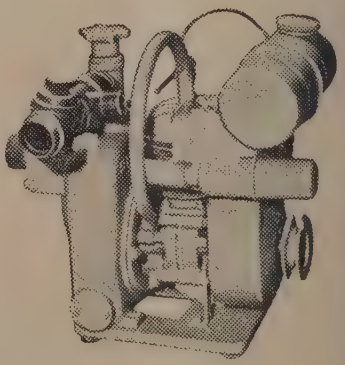

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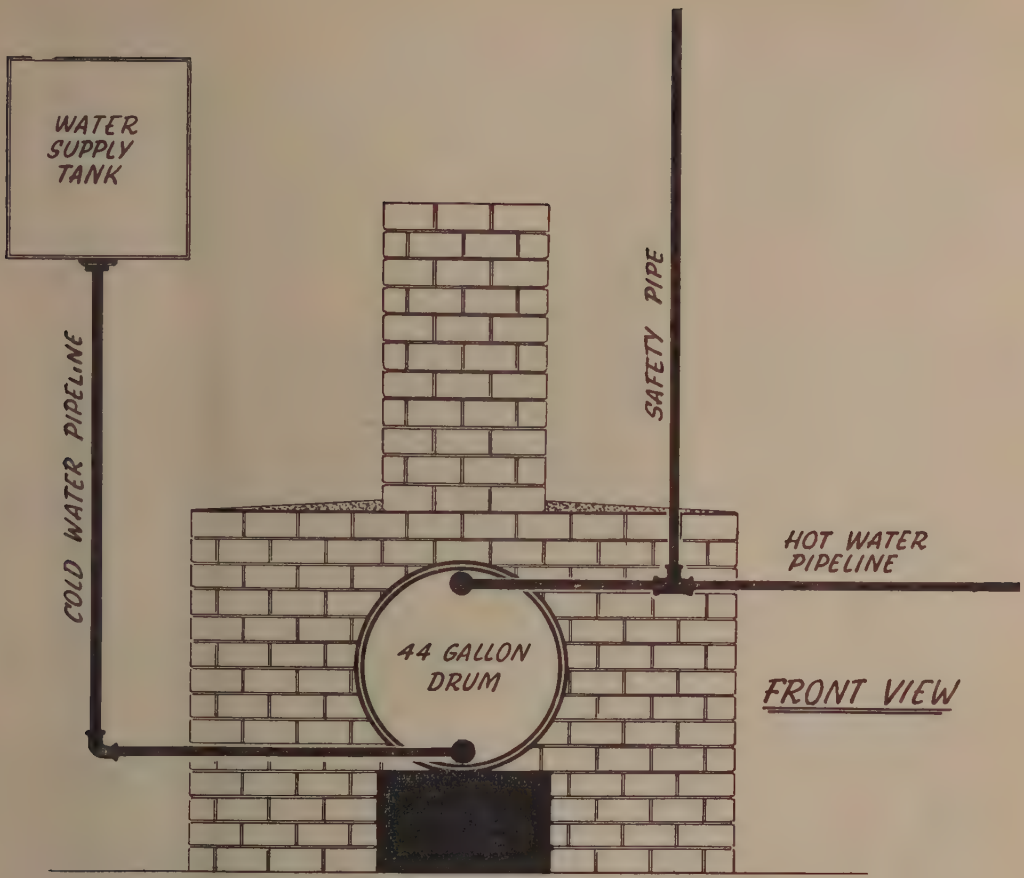

Diagram showing construction of the water heater.

A FARM-MADE WATER HEATER

by

H. MASLIN,
Dairy Instructor

A PLENTIFUL supply of really hot water is a MUST on any dairy farm. Successful dairying calls for meticulous cleanliness of all the equipment used and hot water is always in demand. This simple farm-made hot water system can be constructed by any handyman at very little cost and many units are giving good service in the South-West.

The materials required and approximate costs are as follows:—

	£	s.	d.
1 Heavy-gauge 44 gal. drum	2	0	0
2 ¾in. flanges		8	0
2 ¾in. M and F elbows or nipples		8	0
1 ¾in. tap		12	6
1 ¾in. T-piece		3	0
1 Bag cement		13	6
1 Bag builder's lime		13	0
200 Bricks	3	0	0
Piping (¾in.) .... approx.	1	0	0
	8	18	0

The bricks may not be necessary if ample supplies of suitable rock are available.

The quantity of piping and pipe fittings required will depend upon the location of the supply tank and the dairy premises in relation to the water heater.

If desired 1in. pipe and fittings could be used instead of ¾in.

CONSTRUCTION

The fire-box is built up to a height of about 15in. above ground level, running back the full length of the drum and incorporating a flue at the back. A firebrick or fireclay lining for the firebox is recommended.

Two stout bars of iron, such as a spring-cart axle cut in halves, are built into the brickwork or stonework, spaced so that the weight of the drum is equally distributed when resting upon them.

The two flanges are welded over the two plug-holes already in the top of the drum.

N.B.—Before welding, remove both plugs and wash the drum out thoroughly, swilling it out with several lots of hot water and allowing 10 to 20 gals. of water to remain in the drum, during the welding process. These drums have usually contained petrol or other inflammable liquids.

Set the drum in place and continue to build it in as shown in the diagram. Attach the M and F elbows or nipples and connect the cold water pipe from the supply tank to the lower elbow.

The hot water pipe is connected to the top elbow and carries the T-piece and tap. The safety pipe runs vertically from the T-piece and must extend above the top of the supply tank. Where the supply tank is on a very high stand, it would be advisable to instal a small feeder tank fitted with a ball-tap.

Remember that the supply of water should be constant and the drum must always be kept full.

A water heater of this type is inexpensive to construct, permits the use of large pieces of timber as fuel and ensures a plentiful supply of hot water at all times. The water remains hot for a long time after the fire has been allowed to die down.

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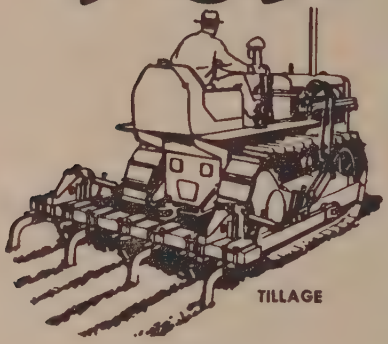

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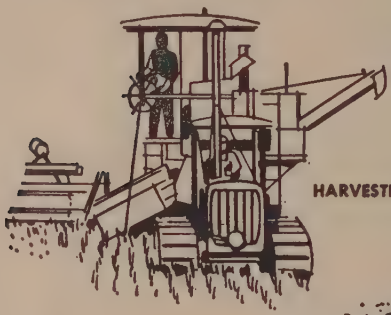

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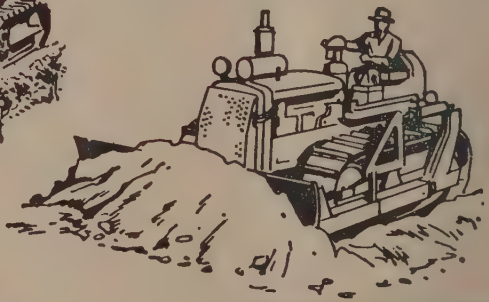

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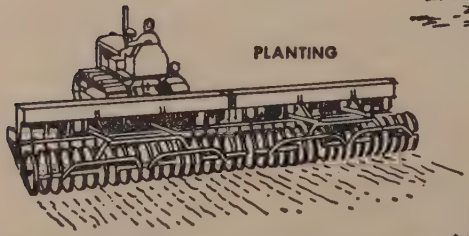

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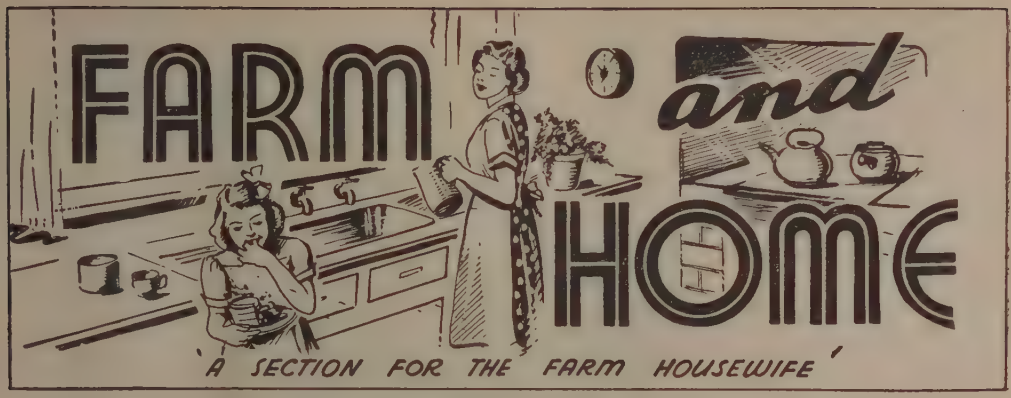


SPARE THAT ROAST

By MARGARET SPENCER

WE still speak of roast dinners when we should really refer to them as baked. Originally, the term "roasting" was used to describe cooking on a spit over an open fire, but today most of our meats are baked in ovens.

Whatever the method however the meat should be tasty and juicy when served, for nobody can enthuse over a dry, unpalatable joint.

How can we be sure of providing appetising fare? First of all we must choose our joint carefully.

That rich, red, coarse-grained piece of steak may make a fine full-flavoured stew but it will not make a good roast. Unlike the "moist heat" methods of cooking which soften tough connective tissue, baking does not make tough meat tender.

But even tender meat—and you can pick it by its fine close grain, the lean portions marbled with fat and its light, clear colour —can be made tough by high temperatures.

If you are still following the old routine of putting your meat into a hot oven for 20 to 30 minutes to "seal in the juices" you are way behind modern practice.

Extensive experiments have shown that this "sealing" actually causes constriction and squeezing out of juices resulting in greater shrinkage and loss of flavour than when a constant, moderately low temperature of 300°-325° is maintained.

Meat is best cooked in an uncovered pan, preferably standing on a wire meat stand, with the fatty side of the meat up. If the meat is very lean some dripping may be placed on top. No basting is necessary.

In large pieces of meat, salt may be added at the commencement of the cooking process without increasing loss of juices to any extent.

Cooking time is usually based on so many minutes per pound—but if the timetable is to be worth anything, oven temperature must be controlled. Remember, too, that a compact and chunky piece of meat will require several minutes per pound more than a long thin joint of the same weight. Boned, rolled roasts too will take longer. Very large joints take fewer minutes per pound than smaller ones. The following table gives a good general guide:—

	Minutes per lb.
Beef	25-30
Beef (thick or rolled)	30-40
Mutton	30-40
Veal and Pork	35-45

FROZEN AND CHILLED MEAT

With the increasing use of frozen meats it is interesting to note that meat may be

cooked directly from the frozen, partially thawed or completely thawed state with practically no difference in shrinkage and flavour when properly cooked.

However, if cooking from the frozen or semi-frozen state, extra cooking time must be allowed and it is easier to get accurate time if meat is thawed first. But don't put the meat into water to thaw it. It is best thawed in the refrigerator as meat spoils quickly if kept too long at room temperature, but whether thawed in the refrigerator or outside it, cook as soon as the meat is thawed, and never re-freeze it.

CARVING AND STORING

If you find carving difficult remember that meat will cut more easily if it is allowed to stand 15 to 20 minutes after removal from the oven, and it should be cut across the grain. Before storing cooked meat in a refrigerator let it cool for at least one hour then wrap it in greaseproof paper and place in the meat compartment or a cold part of the refrigerator. Cooked meat is best wrapped if drying out is to be prevented.

The care you take in selecting, cooking and serving meat pays dividends in tasty meals, rich in body-building nutrients. Heed the golden rule that meat—like all of the protein foods—is better cooked slowly and longer than quickly at high temperatures.

And finally, in cooking that roast why not introduce a new flavour note? Salt and garlic rubbed on mutton before cooking add greatly to the interest of the dish.

QUICK TRICKS IN THE KITCHEN

Ice cubes may be ready for instant use if you remove them from the tray and place them in a paper bag and return them to the freezer compartment. They will not stick together.

* * * *

A sprinkle of nutmeg or mace and a little lemon juice adds a new and delicious note when serving asparagus.

* * * *

Paper towels or tissues are fine for removing excess grease from frying pans, etc., before washing.

Egg whites may be more easily separated from the yolks when eggs are at refrigerator temperature. Egg whites beat more readily when at room temperature to separate them immediately on removal from the refrigerator and allow to stand till they reach room temperature before beating.

* * * *

Paprika sprinkled over light coloured foods such as rice, mashed potato, cauliflower and macaroni adds colour and character too.

KEEP YOUR JOURNALS

HERE at the production end, we are sparing neither expense nor effort in making the "Journal of Agriculture" a publication which will help you in your farming operations.

We suggest that the Journal is worth keeping and that a year's issue will make an attractive and useful volume for your library—a volume that is full of sound factual information, attractively presented.

Arrangements have been made for the compilation of a comprehensive index to be incorporated in the December issue—a feature which will greatly enhance the value of the Journal as a work of reference.

Fig. 1.—A. Typical response at Donnybrook to molybdenum application. No molybdenum has been applied to the plot on the left

MOLYBDENUM FOR SUBTERRANEAN CLOVER

By E. N. FITZPATRICK, Plant Research Division

MOLYBDENUM is one of the elements required for the healthy growth of plants, but it is needed only in very small amounts. Even so it has been shown that some soils cannot meet the requirements of leguminous plants. In Western Australia, molybdenum deficiency of subterranean clover was reported at Donnybrook in 1947, and since then deficient soils have been found at Nannup, Bridgetown and Balingup.

Fortunately the symptoms of molybdenum deficiency are not difficult to recognise and the deficiency is readily overcome by the application of small quantities of molybdenum trioxide, the effect of which can last for a number of years.

Anderson first reported molybdenum deficiency of subterranean clover from South Australia in 1942. Since then Fricke (1944), Anderson (1948) and Newman (1955) have reported the occurrence of the deficiency over wide areas of Tasmania, New South Wales and Victoria respectively.

In Western Australia, Teakle (1945) investigated the effect of molybdenum application on clover growth at a number of sites. Since the original growth increases have been seen on the ironstone gravelly soils in South Australia, this work was carried out on similar soils. At only one site was there any indication of a growth increase.

Later Dunne (1949) reported a very marked increase in clover growth, following molybdenum application, at Donnybrook. It is an extension of this work which is reported here. The only other response to molybdenum application in this State was reported by Rossiter (1951) on clover growing on Muchea sand in a glasshouse.

SYMPTOMS OF MOLYBDENUM DEFICIENCY

Subterranean clover, in common with other legumes, has the ability to use atmospheric nitrogen for growth. This fixation of nitrogen is carried out, in the nodules on the clover roots, by bacteria which live symbiotically with the clover plant.

Although nodules are present on a molybdenum-deficient clover plant, the plant loses the ability to use atmospheric nitrogen. As a result it becomes nitrogen-deficient. The leaves of a molybdenum-deficient plant are uniformly pale green, or yellow, and there may be some reddening of the petioles and older leaves. Leaf size is greatly reduced and the leaves are thin and limp. Often there is plenty of clover in a molybdenum-deficient sward, but the spindly, yellow leaved plants cannot compete with the grasses which become completely dominant.

WHERE MOLYBDENUM DEFICIENCY HAS OCCURRED

Experiments have been conducted in a number of districts in the lower South-West. To date, growth increases have been obtained in the Donnybrook, Bridgetown, Balingup and Nannup districts. Symptoms of the deficiency have, however, been seen along the Darling Scarp as far north as Perth.

The results of some of the experiments conducted in these districts are given in Table I.

TABLE I.

Yield Data (cwt./acre).

Farmer.	District.	Treatment.	Dry Weight.	Clover Weight.
D. P. Reid	Bridgetown	Super only	23·9	10·1
		Super + Molybdenum	31·5	24·8
R. Smith	Bridgetown	Super only	28·1	7·5
		Super + Molybdenum	34·7	18·2
H. Dowrick....	Balingup	Super only	20·2	8·9
		Super + Molybdenum	31·5	21·8
D. Brockman	Nannup	Super only	19·5	..
		Super + Molybdenum	26·6	..

These data show the very substantial growth increases, particularly in clover growth, which have resulted from molybdenum application. The clover yield has been at least doubled in all cases.

THE SOILS WHICH ARE AFFECTED

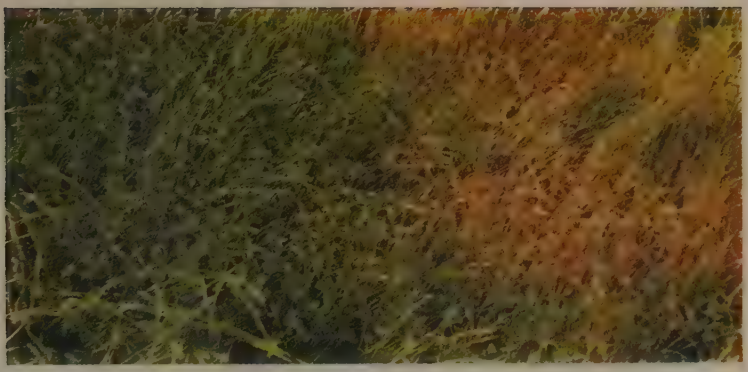
The affected soils are the red-brown and brown sandy loams to clay loams, derived from granites, schists and gneisses, which occur in the Bridgetown, Nannup, Donnybrook and Balingup districts, and along the Darling Scarp. They contain unweathered quartz fragments and have a pH of between 5.5 and 6.0. There is no evidence that molybdenum deficiency of subterranean clover occurs on soils developed over dolerite, or on the ironstone gravelly soils associated with laterite.

In a past geological age the south-west corner of Western Australia was probably covered by a layer of laterite. The soils which are affected by molybdenum deficiency have developed only where this layer has been eroded away, exposing the underlying rocks to weathering. The resultant topography is that of a deeply dissected penoplain with characteristically steep slopes on which the molybdenum deficient soils occur.

The Muchea sand, on which the response to molybdenum application was reported by Rossiter, does not belong to this group of soils. It is a grey, infertile, slightly acid sand, usually several feet deep, with practically its entire plant nutrient reserves in the humus of the surface layer. This soil type is found on the coastal plain north and south of Perth. It is possible that other similar soils on the coastal plain will also respond to molybdenum application.

THE RATE OF MOLYBDENUM REQUIRED AND THE SOURCE OF MOLYBDENUM USED

In the early experiment at Donnybrook, the first growth increase was not seen until eighteen months after the first application of molybdenum. Although it now seems that this delay was caused by a slow build-up in the amount of clover in the pasture, there was the possibility that the molybdenum trioxide used was only slowly made available to the plants. So, when work



Fg. 2.—B. A response to molybdenum at Bridgetown in 1954. The untreated area on the right has dried off while the treated area (left) has survived the spring drought

was commenced to determine the amount of molybdenum required to cure the deficiency, a soluble source, crude sodium molybdate, was compared with the less soluble molybdenum trioxide. These sources were compared at equivalent molybdenum levels. Since there is about a third as much molybdenum in crude sodium molybdate, (20 per cent.), as in molybdenum trioxide, (60 per cent.), 3 and 6 oz. of crude sodium molybdate have an equivalent molybdenum content to 1 and 2 oz. of molybdenum trioxide.

The results of the experiment are given in Table II.

TABLE II.

Donnybrook (Mr. E. F. Draper's Property)
Yield Data (cwt./acre)

Treatments (rates/acre) Super 2 wt. plus	Dry Weight	Clover Weight
1. Nil	26.4	7.1
2. Molybdenum Trioxide 1 oz.	32.8	15.8
3. Molybdenum Trioxide 2 oz.	40.0	19.5
4. Crude Sodium Molybdate 3 oz.	31.8	14.7
5. Crude Sodium Molybdate 6 oz.	37.6	15.6
For Treatment Means P<.05	5.8	5.6
P<.01	8.1	7.9

Examination of these data shows that the molybdenum sources were equally effective in overcoming the deficiency. The data also show that the higher rate of molybdenum (either 2 oz. of molybdenum trioxide, or 6 oz. of sodium molybdate) gave greater yield than the lower rate, which in turn gave greater yield than the control.

It is therefore recommended that the heavy molybdenum rate—equivalent to 2 oz. per acre of molybdenum trioxide—be used to overcome molybdenum deficiency of subterranean clover. In practice molybdenum trioxide is used because it is cheaper per acre to apply than commercial crude sodium molybdate.

THE RESIDUAL VALUE OF MOLYBDENUM TOPDRESSINGS

No direct determinations of the residual value of molybdenum topdressings at the recommended rates have been made. Information from experimental work outside the state indicates that dressings last from eight to ten years. Observations made on the experiment commenced in 1947 showed that the molybdenum treated plots were still healthy six years later. Controlled experiments are now in progress to determine this residual effect, but as these were not commenced until 1954, it will be some years before results are available.

MOLYBDENUM AND ANIMAL HEALTH

If molybdenum is used in excess, the content in the pastures can build up to a level which can have a detrimental effect on animal health. With the rates of molybdenum application recommended above, this build-up does not occur, as the added molybdenum merely raises the molybdenum level in the plant to normal. However, one application is sufficient to overcome the deficiency and molybdenum topdressings should not be repeated annually. Only where there is evidence that the

effect of the initial application is wearing off should a molybdenum dressing be repeated.

VANADIUM AND MOLYBDENUM DEFICIENCY

Overseas workers have suggested that vanadium can take over the function of molybdenum in nitrogen fixation. Since a high level of vanadium in the herbage has no detrimental effect on animal health, it has been suggested that it may be used, instead of molybdenum, on molybdenum-deficient clover pastures. An experiment at Bridgetown has shown that vanadium has no effect on the growth of molybdenum-deficient clover pastures. The results of this experiment are shown in Table III.

TABLE III.

Yield Data (cwt./acre)

Treatment	Dry Weight	Clover Weight
Nil	23.8	16.4
Sodium Vanadate 1 lb./acre	23.2	16.4
Molybdenum trioxide 2oz./acre	34.7	30.2
Sodium Vanadate 1 lb./acre + Molybdenum trioxide 2 oz./acre	32.8	27.1
For Treatment Means P.05	5.0	5.4
P.01	9.8	7.6

These data show that, while there is a marked growth increase following molybdenum application, there is no difference between the vanadium treated plots and the untreated control.

SUMMARY

1. Molybdenum deficiency of subterranean clover occurs in the Bridgetown, Balingup, Donnybrook and Nannup districts.

2. The affected soils are the red-brown and brown soils of variable textures developed from gneisses, granites and schists which have been exposed as the older, more extensive, lateritic mantle has been eroded away.

3. There is no evidence of responses to molybdenum application on soils derived from dolerite or laterite.

4. An application of molybdenum trioxide of 2 oz. per acre completely overcomes molybdenum deficiency of subterranean clover.

5. Sodium Molybdate is an effective source of molybdenum, but is more expensive to apply per acre than molybdenum trioxide.

6. Molybdenum dressings appear to last from eight to ten years.

7. Molybdenum should be used carefully as it is possible for a build-up in the molybdenum content of the plant to occur and reach a level which is detrimental to animal health.

8. There is no evidence that molybdenum can be replaced by vanadium in fertilisers for molybdenum-deficient areas.

Fig. 3. — Subterranean clover showing molybdenum deficiency symptoms—the leaves are small and very pale green

Fig. 13.—Tobacco seedbeds in Southern Rhodesia. The muslin covers have been turned back over the wire arches for watering and spraying

AGRICULTURE IN SOUTHERN AFRICA

Part 2—The Rhodesias and Belgian Congo

By G. H. BURVILL, M.Ag.Sc., Commissioner of Soil Conservation (now Chief Plant Research Officer), Department of Agriculture, Western Australia

SOUTHERN RHODESIA

SOUTHERN Rhodesia covers 96 million acres and has about 5,000 European farmers. The value of their produce in 1953-54 was £A42,400,000.* Tobacco (57.7 per cent.), maize (15.1 per cent.), cattle for slaughter (11.3 per cent.), and dairy produce (3.8 per cent.), are the major items.

A week spent in Salisbury, the capital, and surrounding areas enabled me to see something of farming, the soil conservation and extension work among farmers, as well as agricultural research at the Henderson Research Station, and the Grasslands Research Station. Mr. C. A. Murray, Director of Soil Conservation and Extension, his staff, and other officials arranged a most useful programme.

SOILS AND AGRICULTURE

Southern Rhodesia lies between latitudes 16° and 22° S., i.e. its northern parts are in the latitudes of Wyndham (Western Australia) and Cairns (Queensland) and its southern portions in the latitudes of Onslow (Western Australia) and Mackay (Queensland) (see Plate 3). It is mostly 3,000-5,500 feet above sea level, however, so that the climate is more temperate than corresponding latitudes in Australia. There is lower and much hotter country in the south and south-east in the drier valleys of the Limpopo and Sabi Rivers and their tributaries, and in the Zambesi valley on the north-western border.

The areas used for farming by Europeans are in the higher country between Bulawayo and Salisbury and from

* See "World Crops" March, 1955, p. 124.

NORTHERN & SOUTHERN RHODESIA

Showing Travel Route and Centres Visited

0 100 400 800

SCALE — MILES

Plate 3

Fig. 14.—Grazing land, Chisamba, Northern Rhodesia. The thatch grass *(Hyparrhenia hirta)* in this open thorn savannah has been well managed to avoid bush encroachment

Salisbury to the eastern borders round Umtali. The annual rainfall is 12 to 25 inches in the southern parts and 25 to 40 inches in most of the remainder. Higher rainfall occurs on the mountainous eastern border.

I saw only areas within 50 miles of Salisbury and here winter frosts are quite common and severe. There are large areas of sand veld—gently undulating country with grey sand and sandy loams overlying ironstone gravel layers at about a foot, and with grey and yellow clay at depths of one to two feet. These soils are largely used for tobacco growing (175,000 acres per year) but pastures and crops in rotation are the objective, as a tobacco farmer may have 800 acres of land, and grows his 40-50 acres of tobacco on new land each year. The sand veld carries small trees (*Brachystegia* sp.) and grass. The soils are formed from granite or similar rock, and closely resemble many of the scrub plain soils in the Western Australian wheatbelt e.g. Wongan Hills Agricultural Research Station. The Western Australian soils, also formed from granite, are believed to be relics from a climate which was much wetter than the present 12 to 20 inch rainfall.

Maize is the principal food crop in Southern Rhodesia and forms the staple diet of the natives, supplemented with some meat, peanuts, and beans. Attractive red-brown loams and heavy soils formed from dolerite are favoured for maize. Citrus fruits, with irrigation, do well. Experiments with irrigated sugar cane in the Sabi River valley, have given phenomenal yields. I was told of yields up to 130 tons of cane per acre. Although I did not visit the area, I judged from discussions that the Sabi Valley Research Station probably has conditions similar to the Kimberley Research Station, on the Ord River in the far north of Western Australia.

Cattle and pigs and dairying are important livestock activities. It was interesting to see steers being fed in yards during the dry winter period when natural grasses and crop residues are of poor quality. Silage and hay are fed and the yard manure later carted out to spread on the maize lands. Native labour comes into this type of stock husbandry, as well as into tobacco growing. On one property I saw Sussex steers 22 months old which had put on 350 pounds in 80 days, fed on silage and hay plus urea. Corn cobs with urea were also used for cattle food.

AGRICULTURAL RESEARCH STATIONS

The work of the Henderson Research Station, Salisbury, and the Grasslands Research Station at Marandellas, should be of interest to those concerned with agriculture in Australia's summer rainfall areas. Henderson is in the main maize-growing area and is aiming to work out farming systems combining crops, stock and pastures to improve on the present tendency to specialise towards maize, tobacco or livestock. I made only a brief

Fig. 15.—Clearing typical tobacco land on R. Burton's property, Broken Hill, Northern Rhodesia. Cordwood for firing tobacco kilns is cut from the fallen trees. The remaining brush is removed before burning

visit, but the Annual Report of the Station, of which I have a copy for 1953, gives more details.

Grasslands Research Station at Marandellas is in sand veld 5,500 feet above sea level, and has as much as 18 degrees of frost in winter. With 35 inch summer rainfall on the sandy surfaced soil, contour banks are necessary to prevent erosion on slopes as low as 2½ per cent.

The work at Grasslands is largely directed towards improving the grazing capacity of the land by clearing, and introducing better grasses and legumes. Dr. Oliver West, who visited Australia a few years ago, is in charge. Star grass pasture has given 503 gallons of milk per acre from Friesian cows milked in portable bails. The winter feed was supplemented with silage (18 tons per acre) made from the same area during the summer.

Katambora Rhodes grass from the Zambesi has done better than Australian Rhodes grass. Work is going on with three strains of *Cenchrus ciliaris* (African foxtail), and a seeding strain of *Panicum coloratum*. As legume components for better and more balanced grazing, dahl or pigeon pea, *(Cajanus cajan) and Leucaena glauca* are under trial. The latter grows to 6ft. and is very palatable. The tall-growing pigeon pea has been tried in a double row, separated from the next double row by a 15ft. space planted with Rhodes grass.

Irrigated winter pastures are under trial. There are also trials in depressions which remain moist in the dry winter, but severe frosts are a handicap.

The development of meat sheep by intercrossing Black Head Persian, Dorset and German Merino is in progress.

SOIL CONSERVATION AND EXTENSION

Conservation of natural resources, especially soils, water and forests receives considerable emphasis both on European and native areas.

The most striking feature of the Southern Rhodesian efforts is the ratio of professional conservation staff to the number of farmers. Under the Natural Resources Act, farmers in an area may petition for the declaration of an Intensive Conservation Area. At August 1, 1954, 85 I.C.A.'s were declared and a few more are expected. This means about 60 farms per I.C.A. It is hoped to provide a Conservation Officer—usually a University graduate—to serve each Intensive Conservation Area. Conservation Officers now total 77.

Fig. 16.—Contour bank on native lands, Upper Kaleya, Northern Rhodesia. Built with a Caterpillar D7 tractor drawing a ripper and four-wheel grader

Their efforts are supported by 13 Group Conservation Officers and 17 Extension Officers. The total staff of the Department of Conservation and Extension is listed in the Annual Report to 30 September, 1953, as 146, of whom 123 are professional and technical officers. The expenditure on this Department in 1952-53 was £A455,000 which represents around £A90 per farmer. This Department deals with European farmers only. Agricultural research and other services are not included in its budget. The Native Department deals with native land husbandry on the 25,000,000 acres set aside exclusively for natives.

Every official envelope in Southern Rhodesia has printed at its base "The soil is our greatest asset: help to conserve it." Conservation efforts have included a very widespread use of contour practices, especially contour banks (called contour ridges in Southern Rhodesia). In 1952-53, 98,964 acres were so treated, while since 1929, 838,080 acres have been protected with 46,560 miles of contour ridges and related earthworks. Travelling by air in Southern Rhodesia the contour lines on European farms, and native areas too, have an intensity not seen anywhere in Australia.

One wonders whether the approach to soil conservation has placed too great emphasis on contour earthworks. I was unable during my short visit to judge the severity of the past erosion problems. A Commission headed by Mr. Justice McIlwaine had reported in 1939 that drastic action was necessary to check soil erosion and wastage of other natural resources. As soon as possible erosion control efforts were greatly intensified. It must be remembered too, that this is a summer rainfall area more like northern New South Wales and Queensland than Victoria, South Australia and the agricultural areas of Western Australia. Emphasis in Southern Rhodesia, as in South Africa, is now turning more to the biological rather than mechanical aspects of soil conservation. The 1952-53 Annual Report of the Department of Conservation has this short but very significant passage (p. 15).

> (ii) *Other Conservation Measures.*
>
> It is accepted that a permanent soil cover is the most effective conservation measure against erosion. Because of this it is most encouraging to report an increased interest in grass as a crop in arable rotations.

General advisory services to farmers on aspects other than soil erosion control are being intensified.

Fig. 17.—Woodlands cleared of smaller trees and planted with star grass for pasture, Kambowa, Northern Rhodesia. The hillocks are termite mounds which are commonly 10 to 15 feet high

SUBSIDIES AND FARM PLANNING

The cost of conservation works such as dams and contour earthworks is subsidised in Southern Rhodesia as follows:—

50% in under 25in. rainfall areas.

33⅓% in over 25in. rainfall areas.

The Intensive Conservation Area Committee is also given an amount equal to one ninth of the cost of such works in its area. In 1952-53, I.C.A. Committees received Grants-in-Aid from this and other sources of £A33,000. Subsidies to individuals were £A72,000.

The payment of subsidies is not based on approved farm plans as in South Africa. However, farm planning has been commenced by the Conservation Department as a logical step to encourage more rational use of soil resources. Southern and Northern Rhodesia have been conferring about suitable methods, including consideration of whole catchment areas rather than individual farms.

The scale of expenditure of public funds on soil conservation and related services seems very high by comparison with Australia. But I was informed that Southern Rhodesia was some years ago paying £3,000,000 sterling per year in subsidising food imports. Efforts to protect the soil and improve production therefore assumed great importance.

NORTHERN RHODESIA

ACROSS the Zambesi River from Southern Rhodesia lies Northern Rhodesia, 850 miles long and 450 miles across in its widest part (see map Plate 3). It has a narrow waist about 100 miles wide where a tongue of Belgian Congo comes in from the north-west. This locality is the great Copper Belt area of Northern Rhodesia and Belgian Congo, along the watershed of streams draining north to the Congo River and south to the Zambesi.

European settlement and farming are mainly along the "line of rail"—the railway from Livingstone near Victoria Falls, north-east to Lusaka, the capital, and north to N'Dola and other Copper Belt towns. There are only 1,200 white farmers, for Northern Rhodesia is mainly a native territory (50,000 Europeans, 1,600,000 natives). It has been administered by the British Colonial Office, and so has Nyasaland to its east, but a Federation of Southern Rhodesia, Northern Rhodesia and Nyasaland was set up in 1953 and administrative changes are in progress.

Fig. 18.—Agricultural advisory service booth at a display of native arts and crafts, Leopoldville, Belgian Congo

My guide and main source of information during five days in Northern Rhodesia was Mr. J. Neil Clothier, Chief Conservation Officer of the Department of Agriculture. I had short discussions also with C. W. Lynn, M.B.E., Director of Agriculture and M. Halcrow, O.B.E., Deputy Director. Their department, through various officers, gave me a broad picture of conservation work, agricultural development and problems.

Most of Northern Rhodesia is 3,000 to 5,000 feet above sea level, so that although it lies in the latitudes of Wyndham, Darwin and the far north of Queensland, temperatures are much lower than in those parts of Australia. The climate offers a dry bracing winter, summer rains, and temperatures not too high for the comfort of Europeans.

The Department of Agriculture in Northern Rhodesia deals with both European and native agriculture. As already pointed out, similar Departments in South Africa and Southern Rhodesia are restricted to European farming. Tobacco, maize, cattle for slaughter and dairy produce are important farm products. The supply of perishable foods to the mining population in the Copper Belt and Broken Hill comes mainly from the southern parts of the territory. Whole milk is sent long distances by rail. The problem of providing good quality grazing during the long dry period is similar to that in north Australia; also the problem of suitable pasture legumes. Where the topography is gently undulating, the depressions which are the source of small streams remain moist in winter. These "damboes" are possible places for developing green winter pastures; they correspond to moist "summer land" in winter rainfall areas of southern Australia.

NATURAL PASTURES AND BUSH ENCROACHMENT

The savannah and bush veld country of Transvaal and Southern Rhodesia seem to change gradually to woodlands of much lower natural grazing value in the wetter Copper Belt area of Northern Rhodesia and Belgian Congo where the rainfall is 40 to 50 inches. In grazing country, bush encroachment, to the detriment of the useful grasses, is a problem which apparently requires careful use of grazing animals and fire. Fire can apparently hold back bush encroachment, but throughout South Africa and the Rhodesias, veld firing seems a controversial matter. Farmers want to stimulate grass growth before the rainy season commences, but early burning leaves the dangers of erosion when the rains come. It was interesting to note, however, that it was suggested that Northern Rhodesia would have had much more bush and much less grass, if the natives had not regularly used fire in their system of shifting cultivation.

Fig. 19.—Display of vegetables by native families, Leopoldville, Belgian Congo

In the vicinity of Chisamba I saw an open thorn savannah with well managed *Hyparrhenia hirta* (thatch grass) grazing, which contrasted with a nearby poorly managed area showing lantana and bush encroachment.

IMPROVED PASTURES

In Northern Rhodesia, star grass *(Cynodon* sp.) and *Panicum makarikari* pastures are being developed on tobacco lands and other areas. Velvet bean and sun hemp also show promise. The star grass is not the giant star grass, which because of possible poison properties has been under grave suspicion in Australia, but the Naibasha strain from Kenya (also called No. 2 strain from Southern Rhodesia). One farm I passed near Chisamba milks 200 Friesians for 600 gallons of milk per day, sent to the lead-mining town of Broken Hill. Star grass is the major pasture. At Grasslands Research Station in Southern Rhodesia, Dr. West reported that star grass pasture on sand veld had given 503 gallons of milk per acre per year from a Friesian herd milked in the paddock in portable bails. Silage—18 tons per acre—was made in summer and fed back during the dry, cold winter. At Kambowa Experiment Station, south of N'Dola, Northern Rhodesia, where the 45 inches of rain falls mainly in the December-March period, star grass pasture, planted December 1953, had by July 1954, been strip-grazed twice with an electric fence, and had given very encouraging production. No fertiliser had been used, but superphosphate and nitrogen applications were proposed. Rooted pieces of star grass are planted 3ft. x 3ft. after the land has been cleared and stumped and disc ploughed and disc harrowed.

Gold Coast Napier fodder (elephant grass) at Kambowa was planted in contour rows. It was planted in December with 200 lb. per acre of super in the rows. 200 lb. per acre sulphate of ammonia was applied in late February. Twelve tons per acre green material was cut for silage in May and the aftermath grazed at the end of June. A pit of silage made from maize in the lower part and Napier in the upper part without cutting into small pieces, was of interest. Molasses had been added to the Napier fodder. For each cow half an acre of maize had been cut for silage.

TOBACCO GROWING

An interesting day was spent on Mr. R. Burton's farm at Broken Hill, where

Fig. 20.—New laboratories and offices at M'Vuazi Experiment Station, Lower Congo

tobacco, maize and cattle are produced. Two links with Australia gave added interest. Mr. Burton's father went from Australia to South Africa during the Boer War; Mrs. Burton's attractive garden rockery was made from ironstone lumps (laterite) so familiar to Western Australians as road-making material.

The country is gently undulating in these parts with trees 30ft. to 40ft. high (*Brachystegia* sp. and *Isoberlinia* sp., both legumes) and coarse grasses. Cattle can be grazed during the wet season in the bush country, at the rate of a beast to four acres. The soils are grey sands and sandy loams with ironstone gravel and more clay in the subsoil. Ironstone boulders outcrop in places. The soils have a marked resemblance to many of the Western Australian scrub plain soils and are undoubtedly of similar origin. Such soils are relics of a wetter climate in Western Australia, but in Northern Rhodesia with 30 to 40 inches of summer rainfall, dry winter and senile drainage system, such soils are to be expected in granite country.

Clearing for tobacco cost £15 sterling per acre. Using a D8 bulldozer at £5 13s. per hour, bulldozing costs are £6 sterling per acre. Cordwood for the tobacco kiln furnaces is cut from the felled trees. Stumping and removing the balance of the trees brings costs up to £15 sterling per acre. Burning the fallen vegetation on the land is avoided as far as possible because irregular distribution of ash causes undesirable variability in tobacco crops. After a first crop of tobacco, millet is grown the next year, then a second tobacco crop in the third year. Older cleared lands are seldom used for tobacco; farms combining tobacco, maize and cattle are 3,000 to 4,000 acres each on this "sand" country. Work on improved pastures for the cleared land is proceeding.

Mr. R. Burton grows 110 acres of tobacco with a native labour force of 80 native "boys." Two acres of seedbeds provide 6,000 plants per acre in the field. The main varieties are Bonanza, Hicks, Delcrest and White Stem Orinoco. Yields are 800 to 1,000 lb. of leaf per acre. Much of the tobacco grading is done by grading firms for a charge of 4d. per lb. There is little market for medium and poorer grades and there is about 6 per cent. loss in grading. Mr. Burton estimated that 750 lb. per acre should leave the property for economical production. After grading, this leaves 700 lb. which needs to sell for an average of 45 pence sterling to leave 3s. sterling net on the farm. Grading and commission takes about 8d. per lb. Gross

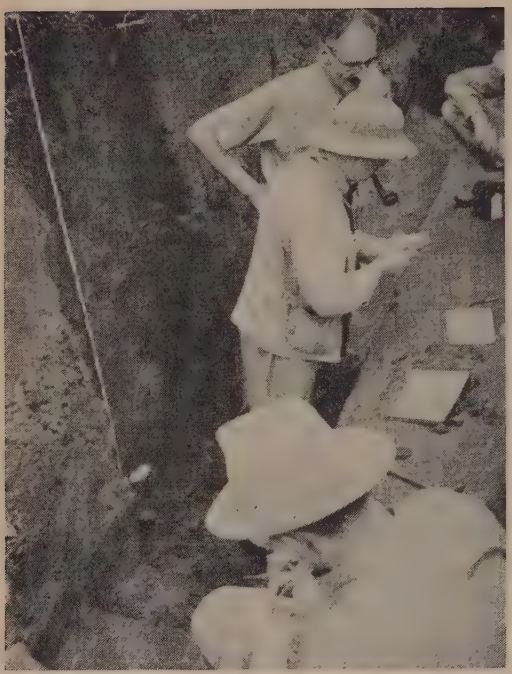


Fig. 21.—Soil scientists examining soil in a trench at Gimbi, Lower Congo. Dr. C. E. Kellogg, U.S.A. (wearing helmet) and M. Ignatieff, United Nations (bareheaded)

return at these prices would be £105 sterling per acre; production costs are between £70 and £80. Fertiliser application for tobacco ranges from 450 to 900 lb. per acre. Two mixtures are used:—"V" containing 8 per cent. nitrogen, 19.5 per cent. phosphoric oxide (P_2O_5) and 15 per cent. potash (K_2O) and, for topdressing, "E" containing 8 per cent. N and 16 per cent. K_2O. The factory price f.o.r. of these mixtures in 1954 was:—"V" £29 4s., "E" £29 1s. sterling per short ton (2,000 lb.).

SOIL CONSERVATION AND FARM PLANNING

The 1,200 European farmers in Northern Rhodesia are developing about 4,000,000 acres of land. Well-developed schemes are in hand to promote farm planning in the interests of overall soil conservation. Work is going on, too, on the native areas where evidence of soil erosion is common, due to overgrazing and faulty cultivation systems for maize crops, and caused also by sledge trails on slopes. Natives are being encouraged to use two-wheeled ox-carts, costing them about £15 sterling each, for carting produce to their villages, instead of the sledges whose trails can so easily wash into gullies. With a cart subsidy scheme operating, sledges will be forbidden.

The Upper Kaleya region about 80 miles south of Lusaka, the capital, was visited as an example of work on native areas. Here soil conservation officers and agricultural instructors were improving the land use in this area of attractive soils. Almost black soils formed from limestone occur, as well as red and red brown soils on dolerite. The area has about 28 inches summer rainfall. On slopes above 5 per cent., cultivation is not allowed. Storm drains on grades of 1:800 or 1:600 are built at the top of the cultivation lands by shuttle-dozing with a D7 bulldozer at a cost of £7 sterling per 100 yards. Lower down, contour banks with variable grades up to 0.3 per cent. are built with a D7 tractor, ripper and four-wheel drawn grader at 35s. sterling per 100 yards. These are at about 12ft. vertical intervals. Between these banks it is planned to build two more contour banks with a Ferguson tractor and single disc "belly" plough. (The disc is mounted between the front and rear wheels of the tractor.) Stock water dams are built in suitable water courses.

The Department of Agriculture has earthmoving plant costing £400,000 sterling for this and similar work.

Farm planning in areas of European farms is being approached on a catchment area basis. Intensive Conservation Areas mostly coincide with catchment areas. Under the Natural Resources Ordinance, 1950, an Intensive Conservation Committee is set up from among the settlers in each I.C.A. Working with these Committees, the Conservation service of the Department of Agriculture organises its officer and machinery.

In relation to modern agriculture, Northern Rhodesia is virtually a young pioneering country, and is attempting in its conservation approach to adopt prevention instead of cure in matters such as soil erosion. Though there has been a feeling that prevention does not attract as much sympathy or support as plans for

curing damage, yet a vigorous and financially supported programme is now going ahead. As already stated, earthmoving plant costing £400,000 sterling is in operation for carrying out the required mechanical works of the programme. The aim is to plan and do the necessary works on 100,000 to 150,000 acres of farms per year. The annual cost of a service for this is estimated at £45,000 sterling embracing planning, direction of works and extension work.

The Government has agreed to provide £50,000 sterling per year for subsidies for approved conservation works, and £100,000 sterling per year for 25-year loans at 4½ per cent. interest to help farmers carry out the plans. Some works of community benefit will get 100 per cent. subsidy up to 2s. 6d. per acre of a property. Others will get 50 per cent. subsidy up to 3s. 9d. per acre. The remaining 50 per cent. may, if necessary be met from the 25-year loan money. (More details of these plans and their application to catchments and individual farms are in my possession.)

To complete the picture, some statistics of food production and imports are hereunder quoted from a paper written in July 1953, by J. Neil Clothier, "Soil and Water Conservation in Northern Rhodesia."

EUROPEAN AGRICULTURAL PRODUCTION FIGURES

	1938.	1949.	1950.	1951.
Maize (bags)	206,024	370,500	477,000	399,450
Wheat (bags)	4,529	1,500	3,250	840
Milk (gallons)	There has been a growing industry			700,000
Butter (lb.)	....	....	....	19,752
Cattle owned by Europeans (head)	125,447	....	135,605	127,387

Other stock is negligible.

1951—FOOD IMPORTS THAT MIGHT BE LOCALLY PRODUCED

Maize (bags)	149,763	Other Meats (lb.)	427,175
Wheat (bags)	180,218	Tinned meat products (lb.)	1,169,724
Slaughter Cattle (head)	44,060	Milk, Dried (lb.)	1,755,112
Sheep (head) ..	7,709	Butter (lb.) .	1,007,290
Pigs (head) .	2,188	Cheese (lb.)	468,930
Bacon and Ham (lb.)	426,946		

The conservation programmes of South Africa, Basutoland, Southern Rhodesia and Northern Rhodesia lead me to conclude that food imports, soil erosion and grassland deterioration on native and European areas, have together developed an urgency about conservation, and a positive approach, which is still largely lacking in Australia. Though all Australian States and Commonwealth Territories are interested in soil conservation and soil erosion and have services of various types and sizes, we have evidently not yet felt the same urgency about a conservation objective, nor the need to plan for it and to support the plans with adequate public funds. And this situation exists in spite of the fact that primary produce from the soil is Australia's major source of wealth.

BELGIAN CONGO

BELGIAN Congo occupies the heart of Africa and embraces much of the basin of the mighty Congo River. Yet it may come as a surprise to know that it is nearly as large as Western Australia, and thus equals about one third of Australia or the United States of America. It extends 350 miles north of the Equator and 900 miles south (see map Plate 4). From its small Atlantic seaboard at the mouth of the Congo, it goes east nearly 1,300 miles to Lake Tanganyika. The annual flow of the Congo River is about twice that of the Mississippi, and is exceeded only by the Amazon.

Unlike South Africa and the Rhodesias, which are mainly 2,000 to 5,000 feet elevation, Belgian Congo is mainly 1,000 to 2,000 feet. Its southern and eastern parts go higher approaching the Congo-Zambesi watershed (over 4,000 feet), and the mountains forming the western wall of the Great Rift Valley of Africa. In the Rift are Lake Albert, Lake Edward, Lake Kivu and Lake Tanganyika (this lake is 400 miles long). Ruwenzori, near the Equator between Lake Albert and Lake Edward rises to 16,795 feet.

Ruanda Urundi is a small Belgian Territory east of Lake Kivu and Lake Tanganyika, between Belgian Congo and Tanganyika.

The course of the Congo River was first traced by Stanley in 1875-77, and he returned in 1879 to found a settlement. For

15°
20°
25°
30°
10°
5°
0°
ANGLO-EGYPTIAN
SUDAN
FRENCH EQUATORIAL AFRICA
CONGO
RIVER
UGANDA
L ALBERT
Yangambi
Stanleyville
Ruwenzori
Equator
Boende
L EDWARD
LAKE
VICTORIA
L KIVU
Ruanda
BELGIAN
CONGO
Urundi
TANGANYIKA
Coquilhatville
Leopoldville
Gimbi
M'vuazi
Matadi
Luluabourg
LAKE
TANGANYIKA
ATLANTIC
OCEAN
ANGOLA
(PORTUGAL)
L MWERU
Jadotville
Elisabethville
N'Dola
NORTHERN
RHODESIA
BELGIAN CONGO
Showing Route Followed & Centres Visited
August 1954
0
100
400
800
SCALE – MILES

Plate 4

Fig. 22.—Jungle growth, Gimbi, Lower Congo

a long time the territory belonged to King Leopold II of Belgium personally, but since 1910 has been a Belgian colony. It is a territory of great natural wealth which the Belgians are now rapidly developing, with considerable emphasis on native education and industry. Exports have nearly doubled since 1945. Exports from mining make up 60 per cent. of the total value, and approach £A90 million. Agricultural exports account for most of the remaining 40 per cent., or £A60 million. Thus agricultural exports are of similar value to those of Western Australia.

Palm oil and palm nuts, cotton, and coffee are the major agricultural exports. Other important products much of which are consumed by the 13,000,000 native inhabitants are:—

	Tons.
Manioc (from cassava) ...	6,700,000
Maize	323,000
Peanuts	180,000
Bananas and plantains	1,800,000
Rice	176,000
Sweet potatoes	300,000

Manioc the carbohydrate from the swollen tuber of cassava is the main native food. It is from manioc that tapioca is made.

The mineral wealth of Belgian Congo comes from copper, cobalt, uranium and industrial diamonds. In the mining areas centred on Elisabethville and Jadotville in the south-east near Northern Rhodesia, the Soil Congress delegates were entertained for a day by Union Miniere de Haut Katanga, the controlling organisation for mining in that region. We were shown over a refinery producing electrolytically 300 tons of pure copper per day. Fifteen tons of cobalt per day is also produced—we were told this is three-quarters of the world production, and is valued at nearly £A1 per pound. A large proportion of the world's industrial diamonds comes from Belgian Congo.

RESEARCH AND ADVISORY SERVICES IN AGRICULTURE

The greatest surprise awaiting an overseas agriculturist visiting Belgian Congo is the vast scale of agricultural research and services. Before I left Australia I had read of I.N.E.A.C.—the agricultural research organisation of Congo. I knew it had a research station at Yangambi, on the Congo River in the heart of Africa. But I certainly did not expect to find 80 European scientists, a total European staff of 150, and 2,000 native employees on this station in such a seemingly remote locality.

After Congo became a Belgian Colony in 1910 its Director General of Agriculture, Professor Leplae, saw the need for experiment stations, visits of experts from other countries, and publications to spread

knowledge of data acquired. Progress was made, but, as in most countries, received a severe check in the depression of 1930. Evidently about this time the need for even more scientific research was appreciated by Prince Leopold, and in 1933, I.N.E.A.C. (l'Institut National l'Etude Agronomique du Congo Belge) was established. It now has a budget of over £A2,000,000 annually for its research and related activities in agriculture and forestry. A further £A6,000,000 is devoted to general agricultural services. A European staff of 700 is assisted by 7,000 native assistants. Of these natives, about 1,000 have training and diplomas in some aspects of agriculture, forestry or veterinary work.

I had no opportunity to see the workings of the agricultural extension services at first hand, as our time in Belgian Congo was almost fully occupied with the Soil Science Congress and its related excursions. The nature and extent of the services were brought to our notice through a display of publications and statistics at the Congress and in a publication "Agriculture Congolaise," 1954.*

Incidentally, one of the first publications to catch my eye was a book of several hundred pages on Australian Eucalypts.

Agricultural systems of a native people in a tropical climate are, of course, vastly different from Australian agriculture. But the great importance attached to agricultural research and advisory services in what we sometimes still term "darkest Africa" is most noteworthy. Fig. 18 shows the agricultural advisory service booth at a display of native arts and crafts arranged for us in the Botanic Gardens at Leopoldville, capital of Belgian Congo, where the main sessions were held.

LE PAYSANNAT

Literally translated this term means "the peasants and their lands." The Belgians have important plans for developing and improving all aspects of the rural economy of the native people. They encourage the native tribes to farm their lands systematically, to use better adapted higher yielding varieties of crops, to control pests and diseases, and to adopt some mechanisation. The growth of crops for sale for cash, like cotton, oil palm and coffee, in suitable localities, is encouraged.

Better housing, schools, hospitals, water supplies, marketing co-operatives are all part of the scheme. Also fish culture wherever possible, to improve the protein diet of the natives. All this is done after the co-operation of the native chiefs has been assured. It is supported by the various native and European staff giving agricultural and veterinary advice, as outlined earlier.

SHIFTING CULTIVATION AND FOREST FALLOW

How to maintain the fertility and productivity of land is a basic feature of the art and science of agriculture. African natives have done it for a long time by shifting cultivation. The forest is cut down and burned, and amongst the stumps and ashes, crops are grown for a few years till yields become very low. Then the area is abandoned and forest regrowth occurs. After 12 or 15 years it can be cut down again and more crops planted, for the deep-rooted trees have gathered into their leaves and branches and wood essential plant needs, which become available for other crops when the trees are cut and burned, or left to rot. A fallow period is one in which no crop is grown, and the treatment of the land is aimed at restoring or building up fertility. In Australia we are accustomed to the practice of bare fallow (or trashy fallow on soils liable to erosion.) The African native uses forest fallow. The secondary forest may grow 50 to 60 feet high in the fallow period under this system near the Equator. Secondary forest at Yangambi 80 miles north of the Equator is shown in Fig. 25. It represents 10 years growth of the very softwooded umbrella tree. The rainfall is 73 inches per annum, with a period in January and February somewhat drier than at other times. Mean monthly temperatures are very uniform throughout the year — maximum 85° F., minimum 68° F.

* Agriculture Congolaise 1954, pp. 75. Publication des Services de l'Agriculture, du Ministere des Colonies et du Gouvernement General du Congo Belge, Leopoldville. Prepared on the occasion of the Inter-African Soils Conference, Leopoldville, August, 1954, held just prior to the 5th International Congress of Soil Science.

The general sequence of operations and crops is shown in the following outline:—

Forest Fallow—Cropping—Yangambi, Belgian Congo.

1 are—1/100 hectares; 50 are—1.2 acres.

The Turumbu Paysannat at Yangambi is based on 50 ares—1.2 acres of crops per family.

December. Cut bush.

1st Year—
January, February. Short dry season for burning.
March. First crop—maize.
July. Harvest maize.
August. Plant bananas, rice and pineapples and cassava (manioc).

2nd Year—
January. Harvest rice.
September. Commence harvesting bananas, harvest manioc and cut back.
October, November, December. Regrowth manioc.

3rd Year—
January, February, March to December. Harvest manioc and bananas.

4th Year—
March. Plant maize.
July. Harvest maize.
September, October. Plant peanuts on half area (25 ares—not acres).
November.
December. Harvest peanuts.
Bush fallow. 13-15 years.

At Yangambi, the upland soils are mainly sandy. They are derived from wind-blown desert sands deposited here during a very dry climatic era in lower Pleistocene times.

The Belgian agricultural scientists are studying ways and means of improving the efficiency of this system. They are encouraging the natives to open up the forests in corridors and on a regular cycle. They are working in the Food Crops Department at Yangambi to breed higher-yielding varieties of maize and peanuts and rice. There are also experiments in mechanical clearing of forest and the use of tractor-drawn ploughs on completely cleared areas. Usually the natives plant by hand in among the stumps and logs. They also have bananas, pineapples and rice planted haphazardly for the same reason.

It seems surprising at first that the use of fertilisers to maintain or improve fertility, instead of the forest fallow, does not receive more attention. But this is an endeavour to improve native agriculture, and natives have too little cash income yet to buy expensive mineral fertilisers. Improved varieties by plant breeding offer much greater scope.

The Food Crops Department of the I.N.E.A.C. Station at Yangambi has 500 varieties of rice (upland varieties about 100), 220 varieties of peanuts, and 200 varieties of maize. It should not be overlooked by workers interested in these crops for northern Australia and New Guinea.

TROPICAL AGRICULTURE—OIL PALM, COFFEE, COCOA, RUBBER

Yangambi, which we reached by an 80-mile river boat trip from Stanleyville, the nearest airport, is the main research station of I.N.E.A.C., but there are 31 others of different orders throughout this vast territory. Three others were visited: —In the Lower Congo, Mvuazi and Gimbi, and in the Katanga area, Keyburg (Elisabethville). The Colonial Agricultural Department also has 40 stations at which selected material is tested, and where suitable systems for local conditions and native agriculture are studied.

At Yangambi much attention is devoted to the plantation crops, oil palm, coffee, cocoa and rubber, as well as food crops, cattle and pigs. The results may be of value in relation to New Guinea. The nutrient requirements of these crops are receiving intensive study by Professor M. V. Homes and his co-workers. Their findings are in the publications of I.N.E.A.C.* The glass house and other experimental facilities at Yangambi for such work are on an elaborate scale.

LOWER CONGO (BAS CONGO)

The Bas Congo is the country extending inland 200-300 miles from the Congo River mouth. From Leopoldville, the capital, beside the Stanley Pool, the river drops 800 feet in about 200 miles over a

* See especially Homes Marcel V. L'alimentation Minérale des Plantes et le Problème des Engrais Chemiques. Science et Lettres Liege 1953 (University of Brussels). Copy in Library of W.A. Department of Agriculture.

Fig. 23.—Fish traps set by natives at Stanley Falls, Stanleyville, in the centre of Africa

series of rapids. There is a railway from Leopoldville to Matadi, the port for ocean ships, and this carries goods brought down the Congo and tributaries by river boats. The Congo is navigable for 1,000 miles upstream from Leopoldville to Stanleyville (see map Plate 4). The boats have a draught up to ten feet. Previously the stern paddle wheel type was used. Some of the earlier boats were brought from the Mississippi, but the latest craft are diesel-powered propeller types, and can do the 1,000 mile journey in four to five days. Shipbuilding is one of Leopoldville's industries.

Timber and bananas are important export products derived from the lower Congo area. It was interesting to see something of the forestry—banana programme in the Gimbi region. Here on steep slopes bananas are grown for several years in State forests to help the regeneration of the limba tree (*Terminalia superba*), on cut-over areas. The banana (Gros Michel variety) provides production for food and export and a nurse crop for the limba seedlings. On some areas of fertile soils (red latosols) cocoa may later be introduced under the shade of the developing forest.

Other products of the lower Congo, either for food or export, are manioc, rice, maize, peanuts, beans fibres (sisal) and palm oil. Cattle are also kept.

This area is about 5 degrees south of the Equator and has a rainfall of 50 to 55 inches, with a definite dry season from May to September.* Although temperatures are fairly high, cloudiness is common in the dry season, due to the movement inland of air from the Atlantic, and this lessens the severity of the dry season.

The M'Vuazi Station of I.N.E.A.C., is concerned with problems of utilisation of the M'Vuazi-Kokozi Forest Reserve which has scattered patches of forest as well as grass and savannah areas. The vegetation and soils have received close study. Some work with breeds of cattle is included. The research station at Gimbi works mainly on food and fibre crops especially sisal (*Agave sisalana*) and *Urena lobata*. The plateau soils here are mainly red and yellow clays, but a very interesting feature to Australians is the occurrence of large amounts of laterite (ironstone) in various places.† The use of lime, as well as fertilisers containing nitrogen, phosphorus, and potassium has given a tenfold increase with sisal compared with plantings receiving none of these additions.

HIGH KATANGA (HAUT KATANGA)

The Haut Katanga area 700-800 miles south of the Equator and the adjacent areas of Northern Rhodesia are in the

* The climate belongs to the Köppen Aw type.
† See Waegemans G. The laterites of Gimbi, I.N.E.A.C. Scientific Series No. 60, 1954.

Fig. 24.—At Yangambi, in the heart of Africa, is a large agricultural and forestry research centre. Here are seen cocoa experiments. The cocoa plants are in concrete cylinders with umbrella trees grown to provide shade

same latitudes as Wyndham, Darwin, and Cape York Peninsula. Likewise, these areas have a five months rainy season in summer, and seven months almost rainless. The winter is, however, much cooler by day and colder by night than north Australia because this inland area is about 4,000 feet elevation. Congo River tributaries drain north from it, and Zambesi tributaries go south. Winter frosts are common. The annual rainfall is about 50 inches.

Belgian Congo and Northern Rhodesia are both interested in developing agriculture in this environment for there are large populations of Europeans, as well as natives, associated with the great mining operations of the region. Living costs, with imported goods, are very high. Some aspects of the work of the Kambowa Experiment Station near N'Dola, Northern Rhodesia, have been mentioned. Work in Belgian Congo is centred on the I.N.E.A.C. Keyburg Experiment Station at Elisabethville.

Tropical fruits fail because of frost. Citrus can be grown, but while lemons and mandarins are good, the quality of oranges and grapefruit has been unsatisfactory. Research on fertilisers and irrigation are in progress.

Temperate fruits show physiological disorders. "Rome Beauty" apples and Chinese peach trees show some promise, however.

Strawberries (St. John variety) do well, also melons (musk and cantaloupe varieties), and potatoes.

Friesian cattle are kept at the Station in studying pastures, fodders and milk production. The production of hay and silage is necessary to tide over the long dry season, although a limited amount of irrigation is possible. Lucerne, velvet beans, and soya beans are under trial. Maize and elephant grass give good yields. With fertiliser, maize has given about 15 tons of green material per acre—10 tons without fertiliser. Elephant grass over a two-year period has yielded about 100 tons per acre in four cuts. Sweet potatoes have been found useful for milk production, using both tops and tubers.

The most promising pasture species so far are:—

Panicum coloratum.
Panicum maximum.
Panicum kavirondo.
Digitaria umfolozi.
Digitaria tsotsoronga.
Melinis minutiflora.
Cynodon dactylon geant (Star Grass).
Paspalum dilatatum.

The use of star grass in Belgian Congo, Northern and Southern Rhodesia suggests

that this grass may warrant more consideration in the summer rainfall parts of Australia.*

LATERITE IS OF COMMON OCCURRENCE

The soils of the High Katanga, and the adjacent Copper Belt area of Northern Rhodesia, have a special interest for Australian soil workers because of the common occurrence of laterite and related features. The country forms the Congo-Zambesi watershed and by natural erosion has been formed into a gently undulating peneplain with senile drainage lines. The geology is complex, including limestones, dolomites, shales, conglomerates and other rocks. There have been climatic changes in the area in past ages. The combination of rocks, climate, topography and time has given soils which include:—

(a) At high levels on almost flat situations a laterite crust remarkably like Western Australian laterite.

Beneath is grey and red mottled clay from shale. This laterite is thought to be a relic of an earlier climatic era.

(b) Red and yellow latesols. These are soils with little colour change from the surface to 4ft. or 5ft.

Ironstone gravel occurs at considerable depth and the soils are well drained.

(c) Grey soils of variable surface texture and mottled sandy clay subsoils, occurring under imperfect drainage conditions around the source of defined streams and drainage lines. Ironstone gravel and lumps occur in these soils and are sometimes found on the surface, probably due to natural erosion.

The soils in which ironstone gravel and lumps are common in the upper few feet of the profile appear most subject to wet season waterlogging. Some, as mentioned above, are at high level, and may belong to a much earlier climatic period.

* I have recently been informed that some Queensland workers are making further trials of star grass. (Personal communication from J. E. Ladewig, Queensland Department of Agriculture and Stock.)

Fig. 25.—Forest fallow at Yangambi. This growth has developed in 10 years on land left fallow (i.e., resting from crops to restore its fertility). It will be cleared again after about 15 years in fallow and food crops will be grown for three years

The opportunity to judge the similarity of the soils of the sandveld areas of Southern and Northern Rhodesia, also some of the soils of the High Katanga and Copper Belt, to the Western Australian laterite and scrub plain soils, was a stimulating personal experience. In the agricultural areas of Western Australia such soils are now under winter rainfall conditions, and most are relics of bygone ages. Where the annual rainfall is over 30 inches, the summer dry, and the topography allows winter waterlogging, ironstone gravels are probably still forming. The Rhodesian, Congo and Australian laterites have all been discussed by Prescott and Pendleton.*

SOIL EROSION

Soil erosion was not an important problem in the areas I visited in the Belgian Congo. From the train some small landslides and gully erosion were seen in hilly country between Leopoldville and Matadi.

* See Prescott, J. A. and Pendelton, R. B. Laterite and lateritic soils. Commonwealth Bureau of Soil Science Tech. Comm. No. 47, 1952.

Fig. 26.—Belgian Congo natives at Yangambi, on the Congo River, in the middle of Africa, about 80 miles north of the Equator

The eastern borders of Congo are more mountainous and steep slopes are cultivated. Here an antierosion organisation (M.A.E.—La Mission Anti-erosive) gives special attention to the prevention and cure of soil erosion. Reafforestation is undertaken as well as contour earthworks. The earthmoving plant available is also used for dams and irrigation and drainage work. In these areas suitable practices to avoid erosion are embodied in plans for improving native agriculture.

THE FIFTH INTERNATIONAL CONGRESS OF SOIL SCIENCE

The Fifth International Congress of Soil Science was the focal point of my visit to Africa. Two hundred soil scientists from all over the world met to discuss soils in formal meetings, at informal gatherings and on field excursions. The papers presented have now been published in four Volumes of Transactions. In many cases soils were being considered as soils —natural objects subject to scientific study merely as natural objects. In other sessions soils were considered as a medium for plant growth, and thus a food-producing medium for the world's increasing population.

Our Belgian hosts had organised most thoroughly, both for the formal sessions at Leopoldville and for the three excursions to the widely separated Bas Congo, Yangambi and Haut Katanga. Only because of the good internal air services was it possible to cope with all this in three weeks, in such a vast territory. Accommodation problems for the large numbers were overcome by using an ocean going ship in the port of Matadi, and a river boat with passenger cabins at Yangambi. To visit Jadotville, a mining centre 100 miles from Elisabethville, the Congress delegates travelled and slept and dined on a new train built for use on the long railway trips going north-west and west from these areas.

With quiet pride the Belgians gave us every possible opportunity to see the way they are developing this vast territory through mining, agriculture and industry. Hydro-electric power is important. The use of the natives, and the parallel efforts to improve conditions for the natives were of great interest and commanded respect. The work in native agriculture has been mentioned. A million Congo native children receive schooling. Natives drive the trains and operate lathes and similar machinery in engineering workshops of the mines. A display of

native arts and crafts and native dancing in the Botanic Gardens at Leopoldville was of absorbing interest, as was a visit to Leopoldville's native market.

ACKNOWLEDGMENTS

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Soil conservation and other Department of Agriculture officials in South Africa, Basutoland, Southern Rhodesia and Northern Rhodesia extended the utmost co-operation and assistance in organising for me to visit appropriate centres, in making available their local knowledge and in arranging transport and accommodation. Thanks are extended to all and in particular to:—

Dr. P. D. Henning, Director of Soil Conservation and Extension, South Africa.

Mr. L. J. Henning, Division of Soil Conservation and Extension, Pretoria, South Africa.

Mr. L. H. Collett, M.B.E., Soil Conservation Officer, Basutoland.

Mr. C. A. Murray, Director of Soil Conservation and Extension, Southern Rhodesia.

Mr. J. Neil Clothier, Chief Conservation Officer, Northern Rhodesia.

In the Belgian Congo all arrangements were handled by the organisers of the Fifth International Congress of Soil Science. Their efforts, in conjunction with other Belgian officials and officers of I.N.E.A.C., deserve the warmest praise.

Summer Feeding of Weaner Beef Steers

by

N. DAVENPORT, B.Sc. (Agric.),
Senior Adviser, Meat Production

IT is a common practice in this State to market beef cattle as weaners and up to a year old, between November and February, thus avoiding the late summer and autumn period when cattle usually lose weight on normal paddock grazing.

Sometimes, for economic or other reasons, it is desirable to hold cattle over the summer for marketing later, and in such cases beef-raisers are faced with the problem of deciding whether the supplementary feeding of oaten grain would be warranted.

A fact-finding trial designed to provide information on this matter was carried out last summer at Cranmore Park.

BEEF CATTLE INVESTIGATIONS

The Department of Agriculture, in conjunction with the Australian Meat Board, is carrying out investigations dealing with the production and management of beef cattle at three centres in the agricultural areas, at Wokalup, Pardelup and at Cranmore Park, Walebing.

"Cranmore Park" is a well-known property owned by the Boolardy Pastoral Company and managed by Mr. Peter Lefroy. It is situated near Walebing in the Moora district and has an annual rainfall of about 17 inches.

THE FEEDING TRIAL

For the purpose of the trial, 30 cross-bred beef-type steers were used. They were March drop animals sired by Shorthorn, Hereford and Aberdeen-Angus bulls and most of them were out of grade Aberdeen-Angus cows. They were weaned early in December, 1955, and at the end of the month were divided into two groups of 15.

From the beginning of January to mid-May, 1956 (about 18 weeks) one group received 5 lb. oaten grain per day, fed daily, in addition to paddock grazing; the other, the control group, had paddock grazing only. The groups were rotated between paddocks so that each group had similar grazing.

At the end of the oat-feeding period both groups were joined as one herd and had normal paddock grazing until sold at the end of September, 1956.

They were held after the expiration of the feeding period in May as it was decided to ascertain whether the group which received the grain supplement would continue to do better than the "grazing only" group under normal winter grazing conditions. All animals were weighed regularly throughout the trial.

SOME INTERESTING RESULTS

Several interesting facts emerged from the trial.

In the first place, the "grazing only" group did not lose weight over the summer period; in fact they gained an average of 68 lb. liveweight per beast over the 4½ month period or approximately ½ lb. per day.

This was partly due to the good paddock feed resulting from the excellent season in 1955 but was largely due to good pasture management.

Some of the pasture, plus an oat crop in the flowering stage, was mown and left lying in the paddocks—a practice which has been found to greatly enhance the nutritive value of the feed.

OAT-FED GROUP SHOWED GREATER GAINS

The group receiving 5 lb. of oats daily gained 108 lb. liveweight per beast—or 40 lb. more than the "grazing only" group. This gain however did not pay half the cost of the oats used and, in view of the labour costs of feeding the supplement, it was definitely uneconomic.

When the oat-feeding was discontinued, this group continued for two months to gain weight more rapidly than the "grazing only" group. They gained an average of 20 lb. liveweight more in the two months, but for the remainder of the period the liveweight gains were similar for both groups.

SUMMARY

The results of this trial over the conditions of last summer showed that during summer, feeding oat grain to beef weaner steers did not pay although weight increases were obtained. Also that liveweight gains during that period are possible without supplementary feeding by the provision of good quality paddock feed. Cutting pasture and cereal hay and letting it lie as cut, or windrowed, is a particularly valuable practice for providing high quality paddock grazing. This has been amply demonstrated with sheep at the research station and appears equally important with cattle. It has been a routine practice at Cranmore Park for a number of years now.

The trial will be repeated this summer. It will be interesting to see what happens after the present mediocre season instead of the very good season experienced last year.

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BLACKBERRY

(*Rubus fruticosus* L.)

The blackberry or bramble is native to Europe but is now naturalised in many countries. At first cultivated for edible fruits, it has now become established on hundreds of acres of good land in the higher rainfall areas of the South-West. Although favouring the fertile valleys, plants also grow vigorously on hillsides.

WEEDS of Western Australia

By **G.R.W. MEADLY** M. Sc.
Officer in Charge, Weeds and Seeds Branch

THE BLACKBERRY OR BRAMBLE

(Rubus fruticosus L.)

THE blackberry is regarded by many people as the source of a tasty fruit prized for jam-making, but it is a problem to the man on the land in many parts of the world. It occurs extensively in south-eastern Australia, including Tasmania, and is also abundant in parts of New Zealand.

Early establishment in Western Australia was associated with the timber industry. Many large areas correspond with old camps and mill sites where doubtless canes were planted with a view to gathering the fruits. These sites were often located in moist valleys favourable for the growth of the bramble which has spread along the valleys and also up the hillsides until now hundreds of acres of fertile land are occupied.

It is apparent that much of the early spread and even some of the recent distribution has been designed rather than accidental. Most of the spread in latter years, however, has occurred as a result of natural agencies. Propagation by means of seeds is supplemented by vegetative reproduction—both suckering and layering. A single plant can spread to occupy a large area without any seeds being allowed to form. Seeds and canes carried by running water are often deposited under favourable conditions some considerable distance from the parent plant. Birds are fond of the berries and have been responsible for widespread dispersal of seeds. Blackberry is a frequent roadside weed and roots are carried readily by road-grading equipment.

The behaviour of the plant so far indicates that, with the exception of the higher rainfall pockets and moist valleys such as at Jarrahdale, Dwellingup and Collie, blackberry is not spreading to any great extent in the area north of a line from Bunbury to Albany. Southward, however—especially in the heavier rainfall areas including Manjimup, Bridgetown, Greenbushes, Balingup, Nannup and Margaret River—blackberry has become thoroughly established and only active control measures are preventing it from spreading.

DESCRIPTION

The vernacular name needs no explanation as the berries, which change in colour from red to black when ripe, are well known to most people.

The blackberry, a member of the rose family, is a vigorous perennial reaching a height of ten feet or more and frequently forming a dense thicket with a strongly-developed rooting system. The stems, leaf-stalks and midribs are armed with strong, hooked thorns while the leaves are divided into three, or sometimes five, separate toothed lobes, as shown in the illustration. The flowers have white or pink petals and the appearance of a miniature briar rose. The fruits consist of numerous globular drupes, at first red but finally black in colour.

Blackberry is a primary noxious weed for the following road districts—Albany,

BLACKBERRY OR BRAMBLE
(Rubus fruticosus L.)
A—Flowering and fruiting branch; B—Leaf; C—Flower; D and E—Fruits
From a pen-drawing by C. A. Gardner, Government Botanist.

Augusta-Margaret River, Balingup, Bridgetown, Bunbury, Busselton, Capel, Collie, Dardanup, Drakesbrook, Greenbushes, Harvey, Manjimup, Nannup, Plantagenet, Preston, and Upper Blackwood, along with the municipalities of Albany and Collie. It is also a secondary noxious weed for the Armadale-Kelmscott Road District.

SIGNIFICANCE

As already indicated, the significance of blackberry depends to a large extent on the viewpoint. To those who pick the fruits for eating, it is a desirable plant, but this is not the opinion of many farmers in the South-West who are concerned about the spread, particularly in the past ten years.

The blackberry is capable of taking possession of land, especially moist fertile soils, to the exclusion of all other growth. It remains relatively dormant during the winter but grows rapidly in the spring and summer. Large bushes soon develop from fragments of cane or seedlings, and extensive dense thickets ten feet or more in height are not uncommon. An old stable and loft near Manjimup is clothed in blackberries to a height of 30 feet.

Although much of the growth occurs in forest country and along roadsides, appreciable tracts of cleared land capable of being productive are infested; the grazing area of many pastures has been reduced as the plants have extended and the presence of the weed in orchards is a further problem for the fruit grower.

Blackberry thickets can also harbour vermin and increase the fire hazard, besides being responsible for torn clothing and severe scratches if not approached with care.

CONTROL

Research into control measures has been undertaken in many countries where the plant is a pest. In 1940 a series of experiments involving cultural and chemical methods were commenced at Bridgetown and Greenbushes. The results showed that where land can be brought under the plough and perennial pasture species established, this is the most satisfactory method. The appropriate pasture species depend mainly on the soil moisture content during the summer months but paspalum, Kikuyu grass, *Phalaris tuberosa*, perennial ryegrass, white clover and subterranean clover can be used to advantage. The young blackberry shoots must compete with the pasture and are also eaten off to a certain extent by cattle in the course of grazing. Any canes that make progress should be slashed.

This method, although practicable under some conditions, cannot be employed along roadsides, in gullies or on steep hillsides, and for such places, along with timbered country, for many years we have thought in terms of an effective chemical. In 1940 a range of chemicals was tried including sodium arsenite, acid sodium arsenite, arsenic pentoxide and sodium chlorate. Sodium chlorate was the most effective but after a period of three years, materials and labour had cost more than £25 per acre and some weak plants still remained. Chemicals were much more effective on areas which carried perennial grasses such as paspalum and where stock were grazing.

No further progress was made with chemical control measures until the advent of the hormone-like herbicides. These manufactured substances have most of the properties of the natural plant hormones including the ability to move through the plant tissue and penetrate to greater depths than herbicides such as sodium chlorate and arsenic pentoxide which have mainly a contact action. The plants react more slowly to the hormone-like substances but the final result is more severe.

The 2,4-D type, the first to become available, caused little permanent effect but when supplemented by 2,4,5-T the reaction was much more severe. Commercial lines for blackberry spraying contain either an ester of 2,4,5-T as the active chemical or, alternatively, mixed esters of 2,4-D and 2,4,5-T. Experimental work and field experience in this State indicate that under our conditions 2,4,5-T alone gives the better results per unit of cost.

The recommended rate of application is three to four pounds of acid equivalent per acre. This is higher than that usually advocated in the Eastern States but is based on quite extensive trials and experi-

Fig. 1. — Blackberry taking possession of a fertile valley near Bridgetown. Spraying to prevent spread in this area has commenced

ence. It has been found that where the water table is high and the plants are shallow rooted, they are killed much more readily than when growing on hillsides and having deep rooting systems. Plants with large soft leaves usually respond more readily than those having small harsh leaves and there is some evidence that dust on the leaves, reduces the effectiveness of the treatment. Plants that have been dwarfed by spraying with other chemicals or have a restricted amount of foliage due to slashing or burning are less susceptible to 2,4,5-T.

For one reason or another much of the blackberry being treated in Western Australia is not highly susceptible and, in the main, the relatively high three to four pound rate of acid equivalent per acre is used.

A complete coverage of the foliage and canes with the solution is most important, and special long "blackberry wands" enable the centres of quite large bushes to be sprayed effectively. This cover can be obtained with 200 gallons of solution per acre of blackberries. For moderate-sized bushes and scattered infestations a knapsack spray pump is satisfactory but with thickets requiring deep penetration, a power unit capable of giving a pressure of 200 lb. per square inch is desirable.

The time of application is important. Best results are usually associated with mid-summer spraying coinciding with flowering and fruit formation. Presumably this is associated with increased downward translocation. Although February and March could be regarded as the optimum months, good results have also followed January and April application. Where the necessity arises, therefore, a programme can be extended over three to four months. After spraying during this period there is little regrowth before the following spring and no necessity for respraying until the corresponding time the following year. In cases where spraying has been undertaken in November, however, a copious regrowth has appeared by the following February or March.

Only on a few occasions under very favourable conditions have blackberry plants been destroyed with a single treatment. Applications in several successive seasons are usually necessary but each is of lesser magnitude than the preceding. As with other chemical and cultural methods, vigorous pasture species along with grazing by cattle are very useful supplementary factors.

There is a strong tendency to burn the plants soon after they ha[illegible] dried, within a few weeks of spraying. [illegible]rning at this stage is most inadvis[illegible]d can nullify the effects of the spray [illegible] in many cases, however, it is necessary to destroy the canes in order to facilitate further spraying and a fire is the cheapest and most

Fig. 2.—Dry canes at Manjimup following spraying in March, 1956. Some regrowth could be expected after the photograph was taken in November, 1956. Competition from the pasture and grazing of the young shoots by stock will assist control

practical method. Investigations in progress indicate that burning should not be undertaken before the beginning of November. It would appear that the spray has then taken full effect. Any shoots present are scorched, and subsequent regrowth is usually at an appropriate stage for spraying by the following February.

During the past two years extensive spraying programmes have been undertaken in the South-West, some 200 acres being treated in the Manjimup district alone. These programmes have been based on co-operation between the Department of Agriculture, Agriculture Protection Board, local authorities, farmers and Government Departments such as Forests and State Saw Mills. Detailed surveys have been undertaken to assess the size of the projects and enable planning to be carried out on a sound basis.

The necessary finance has been provided locally, either by the individual farmers or by local rating. By far the best results have followed a district approach to the problem, the plants being treated on a face irrespective of whether they occur on private, public or government land. Weeds

Fig. 3.—Bushes should not be burnt during the summer spraying. If burning is desirable to facilitate further spraying it should not be carried out before the spring

Fig. 4.—Blackberry to a height of 12ft. extended to a distance of 15ft. each side of this drain. Following spraying in February, 1955, and March, 1956, there was no growth in November, 1956, when the photograph was taken

do not respect boundaries and much of the value of the work is lost if the blackberry is sprayed on one side of a fence and neglected on the other.

The Agriculture Department assisted in an advisory and organising capacity while the Agriculture Protection Board has supplied spraying equipment without charge and made chemical available at a reduced price. In some districts work has been carried out on behalf of farmers, local authorities and Government Department's by the Agriculture Protection Board's mobile spraying units, the cost being met by the parties concerned. These four-wheel-drive vehicles fitted with spraying equipment and towing trailers carrying the 2,4,5-T solution are capable of traversing most of the difficult country on which blackberry occurs.

Control of some of the large thicket areas extending over many acres, at first appeared hopeless, but good progress has been made since tracks for the spraying units have been formed by means of bulldozers, thus enabling penetration by the spray. A few years ago the blackberry held the initiative but during the past two years, in the districts where 2,4,5-T has been used systematically, there has been a substantial decrease.

To conclude with a warning—2,4,5-T is not poisonous, but will affect many cultivated plants, including fruit trees. Tomatoes, grapevines and members of the cabbage family are particularly susceptible. Care should be taken not to allow spray to drift on to such plants and, owing to the difficulty of cleaning spraying equipment, it is advisable to keep a knapsack pump for the use of such chemicals only.

FREE SERVICE TO FARMERS

Do you know that the Department of Agriculture provides a comprehensive service of advice and technical assistance to farmers, free of charge?

When in need of advice, get in touch with your District Officer whose name and headquarters township will be found in the list of Departmental personnel on Pages 2 and 3.

These officers are there to help you and will make personal visits to your property to assist with on-the-spot advice. In addition, they will, where necessary, arrange for the services of specialist officers—all without cost to you.

BLUETONGUE

Its Relationship To The Importation Of Cattle From The U.S.A.

IT was announced by the Commonwealth Health Department a few weeks ago that an embargo had been imposed upon the importation of cattle from the U.S.A. as a precaution against the introduction of bluetongue. This is an infectious disease of sheep which has been mainly confined to the African continent, and it has been responsible for heavy losses in the Union of South Africa, over a period of many years.

by

C. R. TOOP, B.V.Sc.,
Chief Veterinary Surgeon

The infection was at first thought to be confined to sheep, but it was recently revealed during the course of transmission experiments that it may also be present in the blood of apparently healthy cattle.

The disease first made its appearance on the American continent, in Texas in 1948, where it was known as "sore muzzle," and it was subsequently reported in California and Utah in 1952, but it was not until the following year that its true identity was established. Since stud cattle from the U.S.A. were being exported to Australia in considerable numbers, this created an immediate problem for our quarantine authorities.

Bluetongue is highly infectious and is caused by a virus which is transmitted by biting insects such as sandflies. The symptoms as described consist of fever, depression and loss of appetite. There is inflammation, swelling and ulceration of the mucous membranes of the mouth, tongue and nasal passages, which show a bluish discolouration, and this is accompanied by salivation, bleeding and nasal discharge. Affected animals become stiff and lame, and in severe cases there is emaciation, weakness and prostration. The mortality rate is usually of the order of 10 per cent. but may at times reach 30 to 40 per cent., and losses of up to 90 per cent. have been recorded.

It was reported from South Africa that outbreaks of bluetongue in sheep ceased abruptly with the onset of the first hard frosts and that infected cattle ceased to harbour the virus after an interval of three months, and from this it appeared that importations of cattle could be made with safety for a period of about four months extending from February to May. More recent research has, however, shown that cattle may remain infected through-

out the year and that their introduction into Australia at any period would involve a serious risk.

How bluetongue was introduced into the United States has not been definitely determined, but it is known that some Afrikander cattle were imported about 20 years ago and it has been suggested that these animals may have provided a reservoir of infection.

This emphasises the need for constant vigilance on the part of our quarantine services. The consequences to our sheep and wool industries would be extremely serious should an insect-borne infection of this nature ever be introduced and become established in Australia, and it is certain that it could never be eradicated.

I think it will generally be agreed that the embargo which has been imposed is fully justified.

(From a Rural Hour broadcast. By courtesy of the Australian Broadcasting Commission).

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SATISFACTION GUARANTEED

FOOTROT QUARANTINE

Owners of flocks under quarantine for footrot are reminded that the removal of sheep from their properties is subject to the permission of the Department of Agriculture.

Permits are required not only for sheep forwarded to Midland Junction for sale for slaughter, but also for sheep consigned to the meatworks at Fremantle and Albany and to master butchers at Midland Junction and Fremantle. These permits may be obtained upon application to the Department either direct or through a livestock agent.

All sheep forwarded under quarantine permit either by rail or by road for sale for slaughter at Midland Junction will be required to be delivered to the quarantine yards which adjoin the Quarantine Siding.

Sheep from country sidings must be consigned to the Quarantine Siding, Midland Junction, and it will be the obligation of the owner to see that the consignment note is legibly and correctly addressed. The Railway Department will ensure that the sheep are delivered to the destination specified on the consignment note.

Sheep consigned by road will not be permitted to be unloaded at the main saleyards. They must be delivered direct to the Quarantine Siding and immediately after unloading, the vehicle must be thoroughly cleansed by hosing with water under pressure so as to remove all mud and manure at the washing bay provided for this purpose.

Railway trucks used for the transport of sheep with footrot will continue to be cleansed in the railway yards.

The movement of permit sheep must be nominated to the livestock agent not later than 12 noon on the Thursday of the week preceding the week of sale.

It is the purpose of these requirements to prevent the further spread of footrot and the full co-operation of sheepowners in the matter is requested.

INSECT Pests AND THEIR CONTROL

By C. F. H. JENKINS, M.A., Government Entomologist

Formula Change in the Control of Lucerne Flea and Red Legged Earth Mite

IT is estimated that between 300,000 and 400,000 acres of pasture and crop infested with red-legged earth-mite and lucerne flea were treated in 1956 with a Malathion-DDT mixture consisting of 1oz. of DDT and ½oz. of Malathion per acre. In the vast majority of cases the control obtained was excellent, but some concern has been felt at the number of farmers reporting unsatisfactory results against the lucerne flea.

These recommendations were based upon exhaustive research work carried out in this State by Mr. Wallace, of C.S.I.R.O., and there is no doubt that under satisfactory conditions these recommendations would give good results. However, after consulation with Mr. Wallace, who investigated a number of last season's complaints, it is considered that the quantity of Malathion used may have been insufficient to cater for any adverse circumstances during application.

It is now recommended therefore that the quantity of Malathion in the mixture be increased to the equivalent of 1oz. of active ingredient per acre. The recommended rate of application of the mixture thus becomes:—

Malathion—1oz. active ingredient (4 tablespoonsful of 50% Malathion); plus DDT—1oz. (¼ pint of 20% DDT emulsion) per acre.

At current prices this will bring the cost of the material to somewhere in the vicinity of 3s. per acre.

FARMERS

This is YOUR Journal, and it has been written, edited and presented in a sincere endeavour to give you helpful information in an interesting manner.

We would like to have your views on the Journal—to know whether you like it or whether you don't. Drop a line to the editor and tell him the features you like and don't like in this issue—or the features you hope to see in future issues.

LIBRARY SERVICE OF W.A.

BOOKS... *for FARMERS*

THE following books on agriculture have been added to the stock of the Library Board of Western Australia, and may be borrowed freely from any public library associated with the Board, or consulted at the State Library of Western Australia.

GENERAL

AGRICULTURE: THE SCIENCE AND PRACTICE OF BRITISH FARMING, by Sir J. A. S. Watson and J. A. More. 10th Ed. Edin., 1956.

PRACTICAL HORTICULTURE, by J. S. Shoemaker and B. J. E. Teskey. N.Y., 1955.

FARM MANAGEMENT

ACCOUNTS AND THE PRACTICAL FARMER, by R. W. Smith. Lond., 1955.

FARM SERVICE BUILDINGS, by H. E. Gray. N.Y., 1955.

FARM WORK SIMPLIFICATION, by L. M. Vaughan and L. S. Hardin. N.Y./Lond., 1949.

FIRST STEPS IN FARM ENGINEERING, by Seatrail, Pseud. Lond., 1955.

MANAGING THE FARM BUSINESS, by R. R. Beneke. N.Y., 1955.

THE SMALL DAIRY FARM, by A. G. Thomason. Lond., 1955.

AGRICULTURAL MACHINERY

FARM ELECTRIFICATION, by R. H. Brown. N.Y., 1956.

FARM MACHINERY AND EQUIPMENT, by H. P. Smith. 4th Ed. N.Y., 1955.

INTRODUCTION TO AGRICULTURAL ENGINEERING, by H. F. McColly and J. W. Martin. N.Y., 1955.

MACHINES OF PLENTY, by S. H. Holbrook. N.Y., 1955.

PLANNING A FARM FOR HIGHER PRODUCTIVITY. Cambridge University. School of Agriculture. Farm Economics Branch. Cambridge, 1954.

PRINCIPLES OF FARM MACHINERY, by R. Bainer, and Others. N.Y./Lond., 1955.

TRACTORS ON THE FARM: THEIR CHOICE, USE AND MAINTENANCE, by H. J. Hine. 5th Ed. Lond., 1955.

CROP MANAGEMENT

PLANT PROPAGATION, Edited by A. G. L. Hellyer. Lond., 1955.

VEGETABLE PRODUCTION AND MARKETING, by P. Work and J. Carew. 2nd Ed. N.Y. [1955].

FIELD CROPS

LUCERNE INVESTIGATIONS, 1944-1953. Grassland Research Institute, Hurley, England. Hurley (Berks.), 1955.

FRUIT GROWING

THE FRUIT YEAR BOOK, 1955. Lond., 1954.

DISEASES AND PESTS

COPPER COMPOUNDS IN AGRICULTURE AND INDUSTRIAL MICROBIOLOGY. Copper Development Association, Radlett, England. Radlett (Herts.), 1948.

DESTRUCTIVE AND USEFUL INSECTS: THEIR HABITS AND CONTROL, by C. L. Metcalf and W. P. Flint. 3rd Ed. N.Y., 1951.

DIRECTORY, 1956. Association of British Insecticide Manufacturers. Lond., 1956.

FARM FIRES AND THEIR PREVENTION. Fire Protection Association, London. Lond. [1955].

MANUAL OF BACTERIAL PLANT DISEASES, by W. J. Dowson. Lond., 1949.

ORGANIC INSECTICIDES: THEIR CHEMISTRY AND MODE OF ACTION, by R. L. Metcalf. N.Y., 1955.

POTATO DISEASES, by R. McKay. Dublin, 1955.

THE PLANT QUARANTINE PROBLEM, by W. A. McCubbin. Copenhagen, 1954.

THE TOXIC PLANTS OF WESTERN AUSTRALIA, by C. A. Gardner and H. W. Bennetts. Perth, 1956.

SOILS AND FERTILISERS

ALKALI SOILS: THEIR FORMATION, PROPERTIES AND RECLAMATION, by W. P. Kelley. N.Y., 1951.

FUNDAMENTALS OF SOIL SCIENCE, by C. E. Millar and L. M. Turk. 2nd Ed. N.Y., 1951.

THE TRACE ELEMENT CONTENTS OF SOIL, by D. J. Swaine. [Farnham Royal, England.] [1955.]

WATER-SUPPLY AND IRRIGATION

SPRINKLER IRRIGATION, Sprinkler Irrigation Association, Washington, D.C. Washington (D.C.) 1955.

WATER: THE YEAR BOOK OF AGRICULTURE, 1955. United States. Department of Agriculture Year Book Committee. Washington, 1955.

IRRIGATION

SPRAY IRRIGATION OF PASTURE AND FODDER CROPS. Bank of New South Wales. Syd., 1956.

FORESTRY

THE PRACTICE OF SILVICULTURE, by R. C. Hawley and D. M. Smith. 6th Ed. N.Y./Lond., 1954.

LIVESTOCK

ANIMAL BREEDING PLANS, by J. L. Lush. 3rd Ed. Ames (Iowa), 1945.

BEEF CATTLE, by R. R. Snapp, with a chapter on Sterility, by Harry Hardenbrook, 4th Ed. N.Y./Lond., 1952.

BEEF PRODUCTION, by R. V. Diggins and C. E. Bundy. Englewood Cliffs (N.J.), 1956.

PROFITABLE SHEEP, by S. B. Collins. N.Y., 1956.

SHEEP DISEASES, by I. E. Newsom. Baltimore (U.S.), 1952.

SILAGE, by S. J. Watson and A. M. Smith. 2nd Ed. Lond., 1956.

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STOCK FOODS

All foods for stock sold in Western Australia are required by the Feeding Stuffs Act, 1928-51, to be registered annually with the Department of Agriculture. For the purposes of the Act "Foods for Stock" includes stock licks, which in turn embrace all preparations claimed to supply or primarily intended to supply mineral matter to stock.

The registration year for stock foods commences on July 1 each year. When making application for registration manufacturers must submit a guaranteed analysis for each of their products, together with a list of ingredients used in each stock food. Regular inspection and sampling is carried out by officers of the Department to see that stock foods comply with the registered analysis.

Sellers of stock foods are required by the Feeding Stuffs Act to ensure that to each package is clearly and conspicuously attached a label or brand showing the name and place of business of the manufacturer or importer, the registered brand and name of the food or lick and the registered analysis.

A list of stock foods and stock licks which have been registered for the current registration year appears hereunder together with a list of results of analysis of official samples taken by Departmental inspectors.

Before purchasing any food or lick buyers are advised to consult the list of registered stock foods and stock lists from which a comparison of foods or licks of similar types can be made and also to ensure that packages are correctly labelled. If any doubts arise inquiries should be made at the Department of Agriculture, where information on the provisions and requirements of the Feeding Stuffs Act and advice on other aspects of stock feeding can be obtained.

Stock Food.	Applic. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis.						
					Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride (NaCl).	Phosphoric Acid (P_2O_5).	Calcium (Ca).	Other.
					% (Min.)	% (Max.)	% (Max.)	% (Max.)	% (Max.)	% (Max.)	%
A.—Simple Foods.											
1.—*Meat Meals.*											
Whale Meal	8	"N.W.W."	Nor-West Whaling Co., Ltd.	Whale meat and Bones	60·0	10·0 6·0*	1·0	0·8 0·4*	10·8 8·5*	9·5 7·5*	
Meat Meal	19	"MASTER"	Burridge & Warren Pty., Ltd.	Waste meat	40·0	13·0 5·0*	5·0	....	....	....	
Do.	36	"COOGEE"	Anchorage Butchers, Pty., Ltd.	Waste meat products	36·0	18·0	2·0	1·0 *Nil**	12·5 9·0*	12·5 8·0*	
Do.	110	"W.A.M.E."	The W.A. Meat Export Works	Meat, bone and blood	50·0	13·0	2·0	2·0 *Nil**	12·0 7·0*	11·0 6·0*	
Do.	161	"WATSONIA"	Watsons Foods Pty., Ltd.	Abattoir Offal	27·0	19·7 17·7*	1·5	....	17·3 15·3*	15·5 13·5*	
Do.	166	"MIDLAND"	Midland Junction Abattoir Board	Animal offal residues	50·0	18·0 15·0*	2·0	1·5 *Nil**	6·0 4·0*	5·5 3·5*	
2.—*Meat and Bone Meals.*											
Meat and Bone Meal	13	"VITA-MEAL"	Wrights, Ltd.	Animal waste	42·0	13·0 17·0*	2·0	1·5 0·4*	13·0 5·0*	15·0	
Do. do.	39	T.B. & S. in diamond, Albany	Thomas Borthwick & Sons (Aust.), Ltd.	Animal offals	45·0	20·0	4·0	....	10·0 8·0*	9·0 6·0*	
Protein Meal and Bone Meal	41	"CHAMPION"	Sims Cooper (Freezing Works) Pty., Ltd.	Meat Works offal	50·0	18·0 8·0*	5·0	1·0 0·2*	10·5 8·5*	8·0 5·0*	....
Do. do.	53	"IMPERIAL"	W. Angliss & Co. (Aust.), Pty., Ltd.	Animal meat, bones and livers	50·0	16·0 8·p*	2·0	....	....	....	....
Bone and Meat Meal	54	"KITCHENS"	J. Kitchen & Sons Pty., Ltd.	Animal fat and bone	42·5	10·0 7·0*	2·5	1·5 *Nil**	18·0 13·0*	15·2 11·0*	....
Do. do.	118	"APEX"	E. J. Fry Pty., Ltd.	Meat, bone and blood	37·0	12·0	2·0	1·0	15·0 5·0*	15·0 5·0*	....

Feeding Meat and Bone Meal	160	"MERCURY"	H. C. Sleigh, Ltd.	Animal Meat and bone	45·0	14·0 12·0*	1·5	0·7 0·6*	20·0 17·1*	13·0 11·3*	....
3.—Liver Meals.											
Liver Meal	52	"IMPERIAL"	W. Angliss & Co. (Aust.) Pty., Ltd.	Animal livers and lungs	65·0	18·0 10·0*	1·0	....	....	....	....
4.—Whale Solubles.											
Dried Whale Solubles....	7	NOR-WEST WHALING CO., LTD.	Nor-West Whaling Co., Ltd.	Whale meat, bones, etc.	82·0	0·4 0·1*	0·1	2·0 1·4*	1·4 1·1*	1·3 1·0*	....
5.—Fish Meals.											
Cray Meal	37	"ANCHO"	Anchorage Butchers Pty., Ltd.	Waste crayfish products	36·0	12·0 9·0*	10·0	3·5 2·5*	7·0 4·0*	14·0 11·0*	....
6.—Milk Foods.											
Dried Buttermilk Powder	35	"SUNNY WEST"	Sunny West Co-op. Dairies, Ltd.	Buttermilk	29·0	11·0 2·0*	0·5	3·0 1·0*	2·5 1·5*	1·5 0·5*	Moisture 9·7 Ash 8·6 Carbo. Hyd. 43·9
Krafco	55	"KRAFCO"....	Kraft Foods, Ltd.	Dried whey	10·0	1·0 0·5*	Nil	4·2 3·8*	2·4 1·0*	1·5 0·7*	Lactose 68·0
Skim Milk Powder	157	"PETERS"	Peters Creameries (W.A.) Pty., Ltd.	Skim milk	35·30	0·25*	1·0	1·78	2·41	1·29	Lactose 55·0
7.—Wheat and Wheaten. By-Products.											
Wheat Meal	28	"MILLERS"	W. H. Milne & Co.	Wheat	8·00	....	5·00	....	....	....	....
Do.	153	"C" MEAL	W. Thomas & Co. (W.A.), Ltd.	do.	8·0	....	10·0	....	....	....	....
8.—Oats and Oaten By-Products.											
9.—Oil Seed Meals.											
Lin Meal	16	"WESTERN"	David Gray & Co., Ltd.	Malt grains, linseed meal, yeast, whale solubles, pollard, wheat cereals, cobalt, chloride, copper sulphate, manganese sulphate	20·0	5·0*	7·0	1·5 0·5*	1·5 0·5*	1·0 0·15*	....
B.—Compound Foods.											
1.—Cattle Foods.											
16 per cent. Protein Dairy Food	9	"ENERGY"	Harvey Produce Supply	Wheat, barley, oats, bran, pollard, meat meal, bone flour, tech urea, linseed meal, sodium sulphate	16·0	2·0 1·0*	8·0	1·5 1·0*	1·0 0·5*	2·0 1·0*	....
11 per cent. Protein Dairy Food	10	do.	do. do. do.	Wheat, bran, pollard, barley, oats, bone flour, tech urea, sodium sulphate	11·0	2·0 1·0*	8·0	1·5 1·0*	1·0 0·5*	2·0 1·0*	....
11 per cent. Protein Cattle Meal	11	do.	do. do. do.	Wheat, barley, oats, bran, bone flour, tech urea	11·0	2·0 1·0*	10·0	1·5 1·0*	1·0 0·5*	2·0 1·0*	....
Cattle Food	47	"EVE-LYN"	Tropical Traders & Patersons, Ltd.	Gristed wheat, barley, rye, pollard, salt, limestone, chalk, herbs, animal charcoal, molasses, sulphur, sulphate iron, copper sulphate	5·0	2·0 1·0*	5·5	13·0 12·0*	4·25 3·25*	9·5 8·5*	Sulphur 3·6
Sweetened Dairy Meal	101	"WES-FARMERS"	Westrallan Farmers, Co-op., Ltd.	Bran, pollard, wheat germ, cocoanut meal, peanut meal, brewers grain, rolled wheat, meat meal, bone meal, limestone, salt, blue stone	16·0	5·0 2·5*	10·0	3·5 2·0*	3·5 2·3*	2·5 2·0*	....
11 per cent. Sweetened Dairy Meal	102	do.	do. do. do.	Bran, pollard, oat meal, meat meal, bone meal, brewers grain, Limestone, salt, molasses	11·0	5·0 2·0*	10·0	2·0 0·5*	2·0 1·0*	2·5 2·0*	....
Special 11 per cent. Sweetened Dairy Meal	103	do.	do. do. do.	Bran, pollard, oat meal, molasses, bone meal, meat meal, urea, common salt	11·0	8·0 5·0*	7·0	3·0 2·0*	2·0 1·0*	2·0 1·0*	....

* Minimum.

Stock Food.	Applic. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis.						
					Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride (NaCl).	Phosphoric Acid (P_2O_5).	Calcium (Ca).	Other.
Compound Foods—*contd.*					% (Min.)	% (Max.)	% (Max.)	% (Max.)	% (Max.)	% (Max.)	%
Cattle Foods—contd.											
11 per cent. Protein Sweet Dairy Food	139	"THOMAS"	W. Thomas & Co. (W.A.), Ltd.	Pollard, bran, gristed grain, malt combings, rock phosphate, molasses, oyster flour, salt manganese sulphate, iodine, cobalt sulphate	11·0	1·5*	10·0	2·0 1·0*	2·5 1·0*	4·0 1·0*	Manganese 600 p.p.m. Iodine 10·2 p.p.m. Cobalt 30·0 p.p.m.
16 per cent. Protein Sweet Dairy Food	140	do.	do. do. do.	Pollard, bran, gristed grain, malt combings, rock phosphate, molasses, oyster flour, salt manganese sulphate, iodine, cobalt sulphate, tech urea	16·0	1·5*	10·0	2·0 1·0*	2·5 1·0*	4·0 1·0*	do. do.
16 per cent. Protein Sweet Dairy Food	141	do.	do. do. do.	do. do. do.	16·0	1·5*	8·0	2·0 1·0*	2·5 0·2*	4·0 0·75*	do. do.
32 per cent. Dairy Cake Concentrate	142	do.	do. do. do.	Linseed and peanut meal, coconut and whale meal, tech urea, pollard, bone flour, oyster flour, sodium chloride, manganese sulphate, iodine cobalt	32·0	1·5*	10·0	5·0 2·0*	8·5 3·5*	9·0 4·0*	do. do.
Sweet Dairy Food	156	"BROWNE'S"	Browne's Dairy, Ltd.	Bran, pollard, grain meals, brewers grain, phosphate urea, molasses, lime, salt, calcium cobalt, iodine	16·0	5·82 5·0*	14·9	2·0 1·0*	2·5 1·0*	4·0 1·0*	....
2.—*Calf Foods.*											
Calf Food	15	WESTERN	David Gray & Co., Ltd.	Malt grains, milk powder, yeast, whale solubles, pollard, wheat cereals, and trace elements	16·0	6·0*	7·5	1·5 0·5*	1·5 0·5*	1·00 0·15*	....
Do.	34	HARPER'S "STAR"	Robert Harper & Co., Ltd.	Wheat, oats, rice, barley, linseed, mustard, branning, whiting, salt, peas, condiments	12·0	2·5 *	10·0	2·0 1·0*	2·5 1·0*	1·0 0·25*	....
Do.	45	EVE-LYN ..	Tropical Traders & Patersons, Ltd.	Gristed wheat, barley, rye, pollard, linseed, salt, sugar, calk, turmeric, sodium bicarbonate, cream tarter, foenugreek, coriander, copper	8·5	2·0*	3·86	3·5 2·5*	1·25 0·25*	1·0 0·2*	Bicarbonate 66·45 Sulphur 1·75
Do.	57	KAF-O-VITE	Goldsbrough Mort & Co., Ltd.	Wheat and rice pollard, barley, wheat, meat, coconut, peanut, safflour and lucerne meals, calcium bone charcoal and sugar	16·0	7·0 6·0*	8·0	*nil*	2·5*	4·2*	....
Calf Meal "A-B" (A and D_3)	104	WESFARMERS	Westralian Farmers Co-op., Ltd.	Pollard, buttermilk, linseed meal, dried yeast, wheat meal, wheat germ, meat meal, limestone, bone meal, antibiotics and vitamins A and D_3	20·0	5·0 3·0*	3·0	2·0 0·5*	2·5 1·5*	1·5 1·0*	2000 10/per lb. Vita "A" Vita "D_3" 150 10/per lb.
20% Protein Vitamised Antibiotic Calf Food	138	THOMAS	W. Thomas & Co. (W.A.), Ltd.	Linseed and coconut meal, pollard, bone and oyster flour, salt, manganese sulphate, iodine, cobalt, stabilised vitamins A and D_3, procaine penicillin	20·0	2·5*	8·0	3·0 0·5*	2·5 0·2*	2·5 0·5*	Vita "A" 6,000,000 1U/Ton Vita "D_3" 1,800,000 1U/ton Manganese 60 p.p.m. Cobalt 3 p.p.m. Iodine 1·2 p.p.m.
3.—*Sheep Foods.*											
Sheep Nuts	1	WESTERN	Hemphill Gray Oil Mills Pty., Ltd.	Malt grains, yeast, linseed, meat meal, whale solubles, molasses, wheat, rye, barley	20·0	4·0 3·0*	7·5	1·5 0·5*	1·5 1·0*	2·5 1·0*	Cobalt, Copper, Trace Vitamin B.

Sheep Food	48	EVE-LYN	Tropical Traders & Patersons, Ltd.	Gristed wheat, barley, rye, pollard, salts, limestone, chalk, sulphur, animal charcoal, molasses, iron, trace copper, medicinal herbs	5·0	2·0 1·0*	5·0	13·5 12·5*	4·0 3·5*	9·6 8·6*	Sulphur 2·75
Maintenance Sheep Cubes	105	WESFARMERS	Westralian Farmers Co-op., Ltd.	Bran, pollard, wheat meal, wheat germ, peanut meal, meat meal, limestone, salt, cobalt and copper	14·0	6·0 4·5*	6·5	3·5 2·0*	3·5 2·3*	2·5 2·0*	....
Sheep Breeder Cubes	106	do. . .	do. do. do.	do. do. do.	18·0	8·5 7·5*	7·5	3·5 2·0*	4·5 3·5*	2·5 2·0*	....
11% Protein Vitamised Maintenance Sheep Nuts	149	THOMAS	W. Thomas & Co. (W.A.), Ltd.	Bran, pollard, grain meal, bone flour, molasses, oyster flour, sodium chloride and vitamins A and D_3	11·0	1·0*	15·0	2·0 1·0*	2·0 0·5*	3·5 1·5*	Manganese 60 p.p.m. Iodine 1·2 p.p.m. Cobalt 3 p.p.m. Vita "A" 6,000,000 1U/ton. Vita "D_3" 1,800,000 1U/ton.
21% Protein Vitamised Ewe Lamb and Breeder Nuts	150	do.	do. do. do.	Peanut and linseed meal, bran, pollard, urea, molasses, bone flour, oyster flour, sodium chloride, vitamins A and D_3	21·0	2·0*	11·5	4·0 2·0*	3·0 1·0*	4·0 2·0*	do. do.
4.—*Poultry Foods.*											
Laying Mash No. 1 ..	12	WRIGHTS	Wrights, Ltd.	Bran, pollard, wheat meal, meat meal, whale meal, bone meal, gristed oats, oyster flour, common salt	16·0	6·0 3·0*	6·0	1·5 0·75*	3·0 1·0*	3·5 1·0*	....
Fattening Mash	24	MILLERS	W. H. Milne & Co. .	Bran, pollard, gristed oats, meat meal, wheat meal, salt, limestone	13·0	6·0 3·0*	6·0	1·5 0·75*	3·0 1·0*	3·5 1·0*	....
Laying Mash Vit. "A" and "D_3" Fortified	27	do.	do. do. do.	Bran, pollard, wheat meal, whale meal, meat meal, bone meal, gristed oats, oyster flour, salt, vitamins A and D_3	16·0	6·0 3·0*	6·0	1·5 0·75*	3·0 1·0*	3·5 1·0*	Vita "A" 6,000,000 1U/ton. Vita "D_3" 600,000 1U/ton.
Laying Mash No. 1	29	do. . .	do. do. do. ...	Bran, pollard, wheat meal, meat meal, whale meal, bone meal, gristed oats, oyster flour, common salt	16·0	6·0 3·0*	6·0	1·5 0·75*	3·0 1·0*	3·5 1·0*	....
Laying Mash ("A" and "D_3")	30	do.	do. do. do.	Bran, pollard, wheat meal, meat meal, whale meal, gristed oats, oyster flour, salt, vitamins A and D_3	18·0	6·0 3·0*	6·0	1·5 0·75*	3·0 1·0*	3·5 1·0*	Vitamin "A" 6,000,000 1U/ton. Vitamin "D_3" 600,000 1U/ton.
" D " Fattening Mash....	68	MORLAY	R. B. Young Products ...	Pollard, rock phosphate, wheat, oyster flour, whale meal; meat meal	11·0	3·0*	5·5	2·0 0·25*	3·0 1·0*	4·0 1·5*	....
H.P. Laying Mash Vitamin ("A" and "D_3") Fortified	72	do.	do. do. do.	Bran, pollard, rock phosphate, wheat, oyster flour, whale meal, meat meal	20·0	3·0*	5·5	2·0 0·25*	3·0 1·0*	4·0 1·5*	....
H.P. Laying Mash 20% Protein	73	do.	do. do. do.	do. do. do.	20·0	3·0*	5·5	2·0 0·25*	3·0 1·0*	4·0 1·5*	....
Laying Mash	74	do.	do. do. do.	do. do. do.	16·0	3·0*	5·5	2·0 0·25*	3·0 1·0*	4·0 1·5*	....
Laying Mash " A " and "D_3" Vitamin Fortified	75	do.	do. do. do.	Bran, pollard, rock phosphate, wheat, oyster flour, whalemeal, meat meal, vitamins A and D_3	16·0	3·0*	5·5	2·0 0·25*	3·0 1·0*	4·0 1·5*	"A" and "D_3" ·06
Hi-Protein Mash	76	WESFARMERS	Westralian Farmers Co-op., Ltd.	Bran, pollard, wheat, meat meal, whalemeal, bone meal, shell dust	20·0	10·0 6·0*	8·0	0·5 0·1*	5·0 4·0*	2·5 1·5*	....
Hi-Protein Pellets	77	RED COMB	do. do. do.	do. do. do.	20·0	10·0 6·0*	8·0	0·5 0·1*	5·0 4·0*	2·5 1·5*	....
Hi-Protein Mash "A" and "D_3"	78	WESFARMERS	do. do. do.	Bran, pollard, wheat, meat meal, whale meal, bone meal, shell dust, Vitamin A and D_3	20·0	10·0 6·0*	8·0	0·5 0·1*	5·0 4·0*	2·5 1·5*	Vitamin "A" 6,640 1U/lb. Vitamin "D_3" 900 1U/lb.
Hi-Protein Pellets "A" and "D_3"	79	RED COMB	do. do. do.	do. do. do.	20·0	10·0 6·0	8·0	0·5 0·1*	5·0 4·0*	2·5 1·5*	do. do.
"P" All Mash	80	WESFARMERS	do. do. do.	Bran, pollard, rolled wheat, gristed oats, meat meal, or whale solubles, bone meal, oyster flour	16·0	6·0 4·0*	7·0	1·0 *nil**	3·5 2·3*	2·5 2·;*	....

* Minimum.

Stock Food.	Applic. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis. Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride (NaCl).	Phosphoric Acid (P_2O_5).	Calcium (Ca).	Other.
Compound Foods—*contd.*					% (Min.)	% (Max.)	% (Max.)	% (Max.)	% (Max.)	% (Max.)	%
Poultry Foods—contd.											
All Mash Pellets	81	RED COMB	Westralian Farmers Co-op., Ltd.	Bran, pollard, rolled wheat, gristed oats, meat meal, or whale solubles, bone meal, oyster flour	16·0	6·0 4·0*	7·0	1·0 *nil**	3·5 2·3*	2·5 2·0■	....
"P" All Mash "A" and "D_3"	82	WESFARMERS	do. do. do.	Bran, pollard, rolled wheat, gristed oats, meat meal, or whale solubles, bone meal, oyster flour, vitamins A and D_3	16·0	6·0 4·0*	7·0	1·0 *nil**	3·5 2·3*	2·5 2·0■	Vitamin "A" 3,300 1U/lb. Vitamin "D_3" 450 1U/lb.
All Mash Pellets "A" and "D_3"	83	RED COMB	do. do. do.	do. do. do.	16·0	6·0 4·0*	7·0	1·0 *nil**	3·5 2·3■	2·5 2·0*	do. do.
Fattening Mash	90	WESFARMERS	do. do. do.	Bran, pollard, oat meal, rolled wheat, meat meal	13·0	6·0 4·0*	7·0	1·0 *nil**	1·2 0·7*	1·0 0·5*	....
Fattening Pellets	91	RED COMB	do. do. do.	Bran, pollard, wheat, meat meal, whale meal, bone meal, shell	13·0	6·0 4·0*	7·0	1·0 *nil**	1·2 0·7■	1·0 0·5*	....
Cockeral Mash "A" AB ("A" and "D_3")	92	WESFARMERS	do. do. do.	Gristed wheat, bran, buttermilk, brewer's yeast, vitamin A and D_3, meat meal, whale meal, bone meal, manganese, sulphate	18·0	5·0 3·0■	7·0	1·0 *nil**	2·0 1·0*	2·0 1·0■	Vitamin "A" 2,000 1U/lb. Vitamin "D_3" 400 1U/lb.
Cockeral Mash "B" A and D3	93	"WES-FARMERS"	Westralian Farmers Co-op., Ltd.	Gristed wheat, bran, meat meal, meal, whale meal, bone meal, manganese, Vitamins A and D3	18·0	5·0 3·0*	7·0	1·0 *Nil**	2·0 1·0*	2·0 1·0*	Vitamin "A" 2,000 1U/lb. Vitamin "D3" 400 1U/lb.
Cockeral Pellets "A" A, B, A and D3	94	do.	do. do. do.	Gristed wheat, bran, buttermilk, brewers yeast, meat meal, whale meal, bone meal, manganese sulphate, antibiotics, Vitamins A and D3	18·0	5·0 3·0*	7·0	1·0 *Nil**	2·0 1·0*	2·0 1·0*	do do.
Cockeral Pellets "B" A and D3	95	do.	do. do. do.	Gristed wheat, bran, meat meal, whale meal, bone meal, manganese sulphate, vitamins A and D3	18·0	5·0 3·0*	7·0	1·0 *Nil**	2·0 1·0*	2·0 1·0*	do. do.
Laying Mash	113	"PARSONS"	Parsons Pty., Ltd.	Bran, pollard, gristed grains, wheatgerm, whale meal and solubles, meat meal, oyster flour, bone meal, rock phosphate, salt	16·0	2·5*	6·0	2·0 0·25*	3·5 1·0*	3·75 1·0*	....
Do.	114	"APEX"	E. J. Fry Pty., Ltd.	Wheat meal, bran, pollard, meat-meal, whale meal, bone meal, oyster flour	16·0	3·0*	6·0	1·0 0·25*	3·0 1·0*	3·0 2·3*	....
16% Protein Laying Mash No. 1 (All Mash)	127	THOMAS	W. Thomas & Co. (W.A.), Ltd.	Bran, pollard, gristed grains, wheatgerm, whale meal, salt, whale solubles or meat meal, oyster and bone flour, rock phosphate	16·0	2·5*	6·0	2·0 0·25*	3·5 1·0*	3·75 1·0*	....
16% Protein Laying Pellets No. 1 (All Pellets)	128	Do.	do. do. do.	Bran, pollard, gristed grains, wheatgerm, whale meal, whale solubles or meat meal, oyster and bone flour, rock phosphate	16·0	2·5*	6·0	2·0 0·4*	3·50 0·75*	3·75 1·0*	....
16% Protein Vitamised Laying Mash No.1 (All Mash)	129	do.	do. do. do.	Bran, pollard, gristed grain, wheat germ, whale meal and solubles or meat meal, oyster and bone flour, rock phosphate, salt, lucerne meal, stabilised vitamins A and D3	16·0	2·5*	6·0	2·0 0·5*	3·0 1·0*	3·75 1·0*	Vitamin "A" 6,000,000 1U/ton Vitamin "D3" 1,800,000 1U/ton

16% Protein Vitamised Laying Pellets No. 1 (All Pellets)	130	do.	do.	do.	do.	do.	do.	do.	16·0	2·5*	6·0	2·0 0·5*	3·5 0·75*	3·75 1·0*	do. do.
20% Protein Laying Mash	131	do.	do.	do.	do.	Bran, pollard, gristed grains, wheat germ, whale meal, salt, solubles or meat meal, oyster flour, bone flour or rock phosphate			20·0	2·5*	6·0	1·5 0·5*	7·0 2·0*	3·75 1·0*	....
20% Protein Laying Pellets	132	do.	do.	do.	do.	do.	do.	do.	20·0	2·5*	6·0	1·5 0·5*	7·0 2·0	3·75 1·0*	....
20% Protein Vitamised Laying Mash	133	do.	do.	do.	do.	Bran, pollard, gristed grains, wheat germ, whale meal or solubles or meat meal, oyster flour, bone flour, rock phosphate, sodium chloride, vitamins A and D3			20·0	2·5*	6·0	1·5 0·5*	7·0 2·0*	3·75 1·0*	Vitamin "A" 12,000,000 1U/ton Vitamin "D3" 3,600,000 1U/ton
20% Protein Vitamised Laying Pellets	134	do.	do.	do.	do.	do.	do.	do.	20·0	2·5*	6·0	1·5 0·5*	7·0 2·0*	3·75 1·0*	do. do.
13% Protein Vitamised Fattening Mash	135	do.	do.	do.	do.	Bran, pollard, gristed grains, wheat germ, whale meal, whale solubles or meat meal, oyster flour, Bone flour or rock phosphate, vitamins A and D3			13·0	2·0*	6·5	1·5 0·5*	3·5 1·0*	3·75 1·0*	Vitamin "A" 6,000,000 1U/ton Vitamin "D3" 4,800,000 1U/ton
13% Protein Vitamised Fattening Pellets	136	do.	do.	do.	do.	do.	do.	do.	13·0	2·0*	6·5	1·5 0·5*	3·5 1·0*	3·75 1·0*	do. do.
40% Vitamised Universal Poultry Concentrate	137	do.	do.	do.	do.	Whale meal, meat meal or fish meal, bone flour or rock phosphate, oyster flour, manganese sulphate, vitamins A and D_3, riboflavin, trace minerals			40·0	9·0*	1·5	0·4 0·2*	12·5 8·5*	20·5 18·5*	Vitamin "A" 40,000,000 1U/ton Vitamin "D_3" 4,000,000 1U/ton Vitamin "B_2" 12M. per gram
Special Laying Mash	165	"MAYCO"	Maylands Milling Co. Pty., Ltd.			Bran, pollard, wheat meal, meat meal, bone meal, shell, salt			17·0	4·0 3·5*	5·0	1·0 0·75*	3·0 2·5*	3·5 3·0*	....
Concentrate for Broilers	CLAR	K'S "CHECKER MIX"	Barrow Linton & Co.			Maize products, meat and bone meal, blood and liver meal, dried milk products, salt, limestone, bone flour, dicalcic phosphate, manganese sulphate, vitamins B_2, B_{12}, A and D_3			42·0	10·0 8·0*	2·0	2·0 *Nil**	8·0*	10·0*	Procain Penicillin
Concentrate for Breeders	172	do.	do.	do.	....	do.	do.	do.	36·0	9·0 7·0*	2·0	4·5*	8·0*	17·0	....
Concentrate for Caged Layers	173	do.	do.	do.	....	Lucerne meal, meat and bone meal, dried milk products, salt, limestone flour, bone flour, dicalcic phosphate, manganese sulphate, vitamins A and D_3,			34·0	8·0 6·0*	6·0	3·5	8·p*	16·5	....
Concentrate for Penned Layers	174	do.	do.	B_2, B_{12} do.	do.	Meat meal, bone and blood meal, salt, dried milk products, limestone, dicalcic phosphate, manganese sulphate, bone flour and vitamins A and D_3, B_2, B_{12}			38·0	9·0 8·0	2·0	5·0	8·5*	18·0*	....
Fattening Mash	177	"DUKKO"	do.	do.	....	Bran, pollard, wheat meal, barley meal, ground oats and Checkermix Concentrate for Penned Layers			15·0	3·5	5·0	1·0	3·0	3·5	....
Laying Mash	178	"CHECKER-MIX" EGG LAYER	do.	do.	....	do.	do.	do.	18·2	4·3	4·9	Trace	1·0*	Trace	
Broilers Mash	181	"CHECKER-MIX"	do.	do.	....	Bran, pollard, wheat, barley, oats and broiler concentrate			17·0	3·5	6·0	0·5*	2·0*	1·0*	....
Penned Layers Mash	182	do.	do.	do.	....	Bran, pollard, wheat, barley, oats, and penned Layers concentrate			15·5	4·0	7·0	0·5*	2·0*	2·5*	....
Breeders Mash	183	do.	do.	do.	....	Bran, pollard, wheat, barley, oats and breeders concentrate			17·0	4·0	7·0	0·6*	2·0*	2·5*	....

* Minimum.

Stock Food.	Applic. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis. Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride (NaCl).	Phosphoric Acid (P_2O_5).	Calcium (Ca).	Other.
Compound Foods—*contd.*					% (Min.)	% (Max.)	% (Max.)	% (Max.)	% (Max.)	% (Max.)	%
Poultry Foods—contd.											
16% Protein All Mash Ration A and D_3	185	"D" HIGH ENERGY	W. Thomas & Co. (W.A.), Ltd.	Bran, pollard, oats whole or gristed, wheat and whale meal, liquid whale solubles, bone and oyster flour, vitamins A and D_3	16·0	2·5*	7·0	1·0 *Nil**	3·5 2·0*	2·5 2·0*	Vitamin "A" 6,000,000 1U/ton Vitamin "D_3" 1,800,000 1U/ton
16% Protein All Pellet Ration A and D_3	186	do.	do. do. do.	do. do. do.	16·0	2·5*	7·0	1·0 *Nil**	3·5 2·0*	2·5 2·0*	do. do.
16% Protein Chick All Mash Ration 0–12 weeks	187	do.	do. do. do.	Bran, pollard, fine gristed oats or barley, wheat, whale meal, dried butter or skim milk, brewers yeast, bone flour, ribon, vitamins A and D_3, salt, manganese sulphate, liver meal	16·0	3·0*	7·0	1·0 *Nil**	3·5 2·0*	2·5 2·0*	Vitamin "A" 6,000,000 1U/ton Vitamin "D_3" 1,800,000 1U/ton Ribon 6 gr. per ton
19% Protein Breeders Ration for Hens A and D_3	191	do.	do. do. do.	do. do. do.	19·0	4·0*	7·0	1·50 0·25*	4·75 2·25*	3·0 1·5*	do. do.
18% Protein Cockerel Grower Mash 1 B from 7-16 weeks	192	do.	do. do. do.	Bran, wheat meal, meat, whale and bone meal, ribon manganese, sulphate, antibiotic, vitamins A and D_3	18·0	2·5*	4·5	1·0 *Nil**	1·5 0·7*	1·0 0·5*	Vitamin "A" 6,000,000 1U/ton Vitamin "D_3" Mn 15 p.p.m. 1,000,000 1U/ton Ribon 6 gms. To/ton
18% Protein Cockerel Starter Mash 1A-0·6 weeks	193	do.	do. do. do.	Wheat meal, bran, dried buttermilk, meat meal, whale meal, bone flour, manganese sulphate, riboflavine, vitamins A and D_3, liver meal, antibiotics	18·0	2·5*	4·5	1·0 *Nil**	1·5 0·7*	1·0 0·5*	Vitamin "A" 6,000,000 1U/ton Vitamin "D_3" 1,000,000 1U/ton Ribon 6 gms. Mn 15 p.p.m.
5.—*Chick Foods.*											
Chick Starter	25	"MILLERS"	W. H. Milne & Co.	Bran, pollard, wheat meal, meatmeal, ribon, bone meal, salt gristed oats and vitamins A and D_3	16·0	6·0 3·0*	6·0	1·5 0·75*	3·0 1·0*	3·5 1·0*	Vitamin "A" 6,000,000 1U/ton Vitamin "D_3" 600,000 1U/ton
Chick Builder	26	do.	do. do.	Bran, pollard, wheat, bone and meat meal, gristed oats, salt, vitamins A and D_3	15·0	6·0 3·0*	6·0	1·5 0·75*	3·0 1·0*	3·5 1·0*	do. do.
No. 1 Chick Food	31	"ANCHOR"	G. Wood Son & Co. (W.A.) Pty., Ltd.	Peas, barley, wheat maize linseed, whale meal, bone grit, shellgrit	16·0	1·50*	6·0	0·2 0·02	2·0 0·5*	6·0 2·0*	....
Chick Food	32	"H & C"	Haynes & Clements	Wheat, maize, peas, grit	9·0	3·0 1·5*	4·5	....	....	....	CaO 3·0
Growing Mash, Vitamin Fortified A and D_3	69	"MORLAY"	R. B. Young Products	Bran, pollard, ribon, rock phosphate, wheat, oyster flour, whale meal, meat meal	14·0	3·0*	5·5	2·0 0·25*	3·0 1·0*	4·0 1·5*	....
Chick Starter	70	do.	do. do.	Chick grit, bone meal, Apac vitamins A and D_3, bran, antibiotics, nefco, yeast, wheat, whale and meat meals	18·0	3·0*	5·5	2·0 0·25*	3·5 1·0*	4·0 1·5*	....
Chick All mash Vitamins Fortified A and D_3	71	do.	do. do.	Bran, Apac, Vitamins A and D_3, wheat meal, whale meal, bone meal, meat meal, chick grit, Yeast	15·0	3·0*	6·0	2·0 0·25*	3·0 1·0*	4·0 1·5*	....
"P" Chick Mash "A" A B (A and D_3)	84	"WESFARMERS"	Westralian Farmers Co-op., Ltd.	Bran, pollard, cracked wheat, oatmeal, meat meal, buttermilk, bone meal, antibiotics, vitamins A and D_3	16·0	5·0 3·0*	7·0	1·0 *Nil**	2·3 1·2*	1·3 0·8*	Vitamin "A" 2,000 1U/lb. Vitamin "D_3" 180 Cu/lb.

Chick Pellets "A" A B (A and D_3)	85	"RED COMB"	do.	do.	do	do.	do.	do.	16·0	5·0 3·0*	7·0	1·0 *Nil**	2·3 1·2*	1·3 0·8*	do.	do.
"P" Chick Mash "B" (A and D_3)	86	"WES-FARMERS"	do.	do.	do.	Bran, pollard, cracked wheat, oat meal, meat meal, buttermilk, bone meal, Vitamins A and D_3			15·0	5·0 3·0*	7·0	1·0 *Nil**	2·3 1·2*	1·3 0·8*	do.	do.
Chick Pellets "B" (A and D_3)	87	"RED COMB"	do.	do.	do.	do.	do.	do.	15·0	5·0 3·0*	7·0	1·0 *Nil**	2·3 1·2*	1·3 0·8*	do.	do.
"P" Growers Mash (A and D_3)	88	"WES-FARMERS"	do.	do.	do.	do.	do.	do.	14·0	5·0 3·0*	7·0	1·0 *Nil**	2·3 1·2*	1·5 1·0*	do.	do.
Growers Pellets (A and D_3)	89	"RED COMB"	do.	do.	do.	do.	do.	do.	14·0	5·0 3·0*	7·0	1·0 *Nil**	2·3 1·2*	1·5 1·0*	do.	do.
Special Chick Food	112	"PARSONS"	Parsons Pty., Ltd.			Wheat, green peas, maize, sorghum seed, shellgrit			8·0	1·5 0·5*	4·5	0·5 *Nil**	1·0 0·5*	4·0 3·0*		
Growers Mash (A and D_3	115	"APEX"	E. J. Fry Pty., Ltd.			Bran, pollard, wheat, meat and bone meal, buttermilk, vitamins (A and D_3)			15·0	3·0*	6·0	1·0 0·25‖	2·0 1·1‖	3·0 1·5*	Vitamin "A" 3,000 Vitamin "D_3" 300	
Chick Starter (A and D_3)	116	do.	do.	do.		do.	do.	do.	17·0	3·0*	6·0	1·0 0·25‖	2·0 1·1‖	3·0 1·5*	do. do.	do. do.
Chick Food	117	do.	do.	do.		Wheat, maize, peas, oats, shellgrit			10·0	3·0‖	6·5	..	.	2·0*	..	
Chicken Grain	120	"THOMAS"	W. Thomas & Co. (W.A.), Ltd.			Wheat, maize, peas, shellgrit			9·0	1·5*	4·5	..	....	..	..	
18% Protein Antibiotic Chick Starter (Nefco)	121	do.	do.	do.	do.	Bran, pollard, cereal meals, wheat germ, meat or whale meal, whale solubles, lucerne pollard, pea meal, bone meal or rock phosphate, oyster flour, ribon, procaine, pencillin, stabilised vitamins A and D_3, nitrofiurozone (nefco)			18·0	2·5*	6·0	1·5 0·25*	3·0 1·0*	2·5 1·0*	Vitamin "A" 6,000,000 1U/ton Vitamin "D_3" 1,800,000 1U/ton	
18% Antibiotic Vitamised Chick Granules (Nefco)	122	do. ..	do.	do.	do.	do.	do.	do.	18·0	2·5*	6·0	1·5 0·25*	3·0 1·0*	2·5 1·0*	do.	do.
18% Protein Antibiotic Vitamised Chick Starter	123	do.	do.	do.	do.	Bran, pollard, cereal meals, wheat germ, meat or whale meal, whale solubles, lucerne pollard, pea meal, bone meal or rock phosphate, oyster flour, ribon, procaine, pencillin, stabilised Vitamins A and D_3			18·0	2·5*	6·0	0·25‖ 0·25*	1·0* 1·0*	1·0* 1·0*	do.	do.
Chick Granules	124	do.	do.	do.	do.	do.	do.	do.	18·0	2·5*	6·0	1·5 0·25*	3·0 1·0*	2·5 1·0*	do.	do.
Chick Grower	125	do. ..	do.	do.	do.	Bran, pollard, gristed grains, wheat germ, meat or whale meal or whale solubles, bone and oyster flour, rock phosphate, salt, ribon, stabilised vitamins A and D_3			15·0	2·5*	6·0	1·25 0·5*	3·5 1·0*	3·75 0·5*	do.	do.
15% Protein Vitamised Growers Pellets	126	do.	do.	do.	do.	Bran, pollard, gristed grains, wheat germ, meat or whale meal, or whale solubles, bone and oyster flour, rock phosphate, salt, ribon, stabilised vitamins A and D_3			15·0	2·5*	6·0	1·25 0·5*	3·5 1·0*	3·75 0·5*	do.	do.
Special Chick-Starter	163	"MAYCO"	Maylands Milling Co.			Bran, pollard, wheat meal, meat meal, bone meal, shellgrit, salt, ribo-flavine, emulsified fish oil			17·0	4·0 3·5*	5·0	1·0 0·75‖	3·0 2·5*	3·5 3·0*	Manganese Sulphate ·025	
Growing Mash	164	do.	do.	do.		do.	do.	do.	15·0	4·0 3·5*	5·0	1·0 0·75‖	3·0 2·5*	3·5 3·0*	do.	do.
Concentrate for Growers	175	CLARKS "CHECKER MIX"	Barrow Linton & Co.			Maize products, salt, limestone, meat, bone and blood meals, dried milk products, bone flour, dicalcic phosphate, manganese sulphate, vitamins A and D_3, B_2, B_{12}			38·0	9·0 8·0*	2·0	4·0	8·5*	13·0*	..	

* Minimum.

Stock Food.	Applic. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis. Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride (NaCl).	Phosphoric Acid (P_2O_5).	Calcium (Ca).	Other.
					% (Min.)	% (Max.)	% (Max.)	% (Max.)	% (Max.)	% (Max.)	%
Compound Foods—*contd.*											
Chick Foods—contd.											
Concentrate for Chicks	176	CLARKS "CHECKER MIX"	Barrow Linton & Co.	Maize products, salt, limestone, meat, bone and blood meals, dried milk products, bone flour, dicalcic phosphate, manganese sulphate, vitamins A and D_3, B_2, B_{12}	42·0	9·0 8·0*	2·0	2·5	7·5*	9·5*	....
Growers Mash	179	"CHECKER MIX" ROWELL	do. do.	Bran, pollard, wheat and barley meals, ground oats and Checker-Mix Concentrate for Growers	17·4	4·5	4·6	Trace	1·0*	Trace	....
Chick Starter	180	"CHECKER-MIX" VITALIZER	do. do.	Bran, pollard, wheat and barley meals, ground oats, and Checker-Mix Concentrate for chicks	20·0	4·3	4·4	Trace	1·0*	Trace	....
16% Protein Chick Pellet Ration 0–12 weeks	188	"D" HI-ENERGY	W. Thomas & Co. (W.A.), Ltd.	Bran, pollard, fine gristed oats or barley, wheat, whale meal, dried butter or skim milk, brewers yeast, bone flour, ribon, vitamins A and D_3, manganese sulphate, liver meal, antibiotics	16·0	3·0*	7·0	1·0 *Nil**	2·3 1·2*	1·3 0·8*	Vitamin "A" 6,000,000 1U/ton Vitamin "D_3" 1,800,000 1U/ton Ribon 6 gms./ton Mn 33 p.p.m.
15% Protein Chick Growers Ration 13-18 weeks	189	do.	do. do. do.	Bran, pollard, fine gristed oats or barley, wheat, salt, whale meal, bone flour, vitamins A and D_3, manganese sulphate	15·0	3·0*	7·0	1·0 0·2*	2·3 1·2*	7·5 1·0*	Mn 33 p.p.m. Vitamin "A" 6,000,000 1U/ton Vitamin "D_3" 4,800,000 1U/ton
15% Protein Chick Pellets Growers Ration 13–18 weeks	190	do.	do. do. do.	Bran, pollard, fine gristed oats or barley, wheat, salt, whale meal, bone flour, vitamins A and D_3, manganese sulphate	15·0	3·0*	7·0	1·0 *Nil**	2·3 1·2*	1·5 1·0*	do. do.
Vitamised 16 % Chick Starter	195	"RICH FOODS"	A Richards & Co.	Bran, pollard, wheat meal, meat meal, buttermilk, yeast, oat meal, bone meal, micratized Vitamins A and D_3	16·0	5·0 3·0*	7·0	1·0 *Nil**	3·0 1·0*	3·0 0·8*	Vitamin "A" 2,000 1U/lb. Vitamin "D_3" 500 1U/lb.
15% Vitamised Growers Mash	198	do.	do. do.	Wheat meal, meat meal, whale meal, bran and pollard, oat meal, bone meal, vitamins A and D_3	15·0	5·0 3·0*	7·0	1·0 *Nil**	3·0 1·0*	3·0 0·8*	do. do.
6.—*Turkey Foods.*											
Turkey Starter Mash	96	"WESFARMERS"	Westralian Farmers Co-op., Ltd.	Bran, pollard, gristed oats, wheat, buttermilk, dried yeast. meat meal, bone meal, stabilised vitamins A and D_3	24·0	5·0 3·0*	7·0	1·0 *Nil**	2·0 1·0*	2·0 1·0*	Vitamin "A" 4,000 1U/lb. Vitamin "D_3" 600 1U/lb.
Turkey Starter Pellets	97	do.	do. do. do.	do. do. do.	24·0	5·0 3·0*	7·0	1·0 *Nil**	2·0 1·0*	2·0 1·0*	do. do.
Turkey Growers Mash....	98	do.	do. do. do.	do. do. do.	20·0	5·0 3·0*	7·0	1·0 *Nil**	2·0 1·0*	2·0 1·0*	do. do.
Turkey Growers Pellets	99	do.	do. do. do.	do. do. do.	20·0	5·0 3·0*	7·0	1·0 *Nil**	2·0 1·0*	2·0 1·0*	do. do.
7.—*Pig Foods.*											
Pig Food	46	"EVE-LYN"	Tropical Traders & Patersons, Ltd.	Gristed wheat, barley and rye, pollard, salt, limestone, chalk sulphate, animal charcoal, sulphate iron, limonite, copper, coriander, arecearute, foenugreek	5·0	1·0*	5·0	9·6 8·6*	3·75 3·25*	9·5 8·5*	....

Pig Mash H.P.	66	"MORLAY"	R. B. Young Products	Pollard, rock phosphate, wheat meal, whale meal, meat meal, limestone	17·0	3·0*	6·0	2·0 0·25*	3·0 1·0*	4·0 1·0*	....
Pig Mash Standard	67	do.	do. do.	do. do. do.	14·0	3·0*	6·0	2·0 0·25*	3·0 1·0*	4·0 1·5*	....
Pig Mash	100	"WES-FARMERS"	Westralian Farmers Co-op., Ltd.	Bran, pollard, polled wheat, meat and bone meal, limestone, copper	16·0	7·0 5·0*	8·0	2·0 1·0*	3·5 2·3*	2·5 2·0*	....
18% Protein Antibiotic Vitamised Pig Starter	143	"THOMAS"....	W. Thomas & Co. (W.A.), Ltd.	Manganese, iodine, cobalt, vitamins A and D_3, pollard, wheat germ, gristed grains, meat or whale meal or solubles, oyster and bone flour or rock phosphate, salt, ribon, pencillin	18·0	2·5*	6·5	2·0 1·0*	3·75 1·0*	4·0 1·0*	6,000,000 1U/ton Vitamin "A" 1,800,000 1U/ton Vitamin D_3 Manganese 60 p.p.m. Cobalt 3 p.p.m. Iodine 1·2 p.p.m.
18% Protein Antibiotic Vitamised Pig Starter Pellets	144	do.	do. do. do.	do. do. do.	18·0	2·5*	6·5	2·0 1·0*	3·75 1·0*	4·0 1·0*	do. do.
16% Protein Antibiotic Vitamised Pig Grower	145	do.	do. do. do.	Manganese, iodine, cobalt, vitamins A and D_3, pollard, wheat germ, gristed grains, meat or whale meals or solubles, oyster and bone flour or rock phosphate, salt, Pencillin	16·0	2·5*	6·5	2·0 1·0*	3·5 1·0*	4·5 1·0*	do. do.
16% Protein Antibiotic Vitamised Pig Grower Cubes	146	do.	do. do. do.	do. do. do.	16·0	2·5*	6·5	2·0 1·0*	3·5 1·0*	4·5 1·0*	do. do.
14% Protein Pig Fattening Mash	147	do.	do. do. do.	Manganese, iodine, cobalt, pollard, wheat germ, gristed grains, meat or whale meal or solubles, oyster and bone flour or rock phosphate, salt ribon	14·0	2·5*	6·0	2·0 1·0*	3·75 1·0*	4·0 1·0*	Iodine 1·2 p.p.m. Cobalt 3·0 p.p.m. Manganese 60 p.p.m.
14% Protein Pig Fattening Cubes	148	do.	do. do. do.	do. do. do.	14·0	2·5*	6·5	2·0 1·0*	3·75 1·0*	4·0 1·0*	do. do.
8.—*Horse Foods.*											
Horse Food	44	"EVE-LYN"....	Tropical Traders & Patersons, Ltd.	Pollard, barley, gristed wheat, whole linseed, salt, chalk, iron, magnesium sulphate, sulphur, copper, sodium bicarbonate, med herbs	8·5	3·0 2·0*	7·0	5·0 4·5*	1·0 0·5*	1·75 0·75*	Sulphur 1·25
12% Protein Sweet Horse Food	151	"THOMAS"	W. Thomas & Co. (W.A.), Ltd.	Mill offal, grain meals, molasses, malt combings, bone flour, rock phosphate, oyster flour, salt, manganese sulphate, stabilised iodine, cobalt sulphate	12·0	1·5*	10·0	2·0 1·0*	2·5 1·0*	4·0 1·0*	Iodine 1·2 p.p.m. Cobalt 3·0 p.p.m. Manganese 60 p.p.m.
9.—*Dog Foods.*											
Puppy Meal	3	"SNAPS"	Snaps Dog Foods	Wheat, bone meat and vegetables	15·0	6·0 4·0*	2·0	0·6 0·3*	4·0 3·0*	4·5 3·5*	Carbohydrates 62·00
Charcoal Shapes	4	do.	do. do.	do. do. do.	14·0	5·0 3·0*	6·0	0·7 0·4*	3·0 2·0*	3·0 2·0*	do. do.
Plain Shapes	5	do.	do. do.	do. do. do.	15·0	5·0 4·0*	2·0	0·7 0·4*	4·0 3·0*	4·0 3·0*	do. do.
No. 1 Dog Biscuits	6	do.	do. do.	do. do. do.	15·0	5·0 4·0*	2·0	0·7 0·4*	4·5 3·0*	4·5 3·5*	do. do.
Dog and Cat Food	33	"TUCKER BOX"	Tucker Box Dog and Cat Food Co.	Meat and meat by-products, cereals, vegetables, salt	10·0	5·0 2·5*	0·5	1·0	....	....	....
Dog Meal A B (A and D_3)	109	"WES-FARMERS"	Westralian Farmers Co-op., Ltd.	Bran, pollard, meat meal, dried yeast, buttermilk, bone meal, salt, antibiotics, vitamins A and D_3	20·0	8·0 4·0*	5·0	2·0 1·0*	2·5 1·0*	3·0 1·0*	Vitamin "A" 4,000 1U/lb. Vitamin "D_3" 450 cu/lb.
20% Protein Kanine Kibbles	152	"THOMAS"	W. Thomas & Co. (W.A.), Ltd.	Predigested cereal meals, wheat germ, grain meals, meat meal, milk powder, molasses, oyster flour, bone flour, salt, potassium iodide vitamins A and D_3, B_1	20·0	1·0*	2·5	1·5 0·5*	2·5 0·5*	2·5 0·5*	Vitamin "A" 6,000,000 1U/ton Vitamin "D_3" 1,800,000 1U/ton

* Minimum.

Stock Food.	Applic. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis. Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride (NaCl).	Phosphoric Acid (P_2O_5).	Calcium (Ca).	Other.
					% (Min.)	% (Max.)	% (Max.)	% (Max.)	% (Max.)	% (Max.)	%
C.—Stock Licks.											
1.—*Bone Meal.*											
Whale Bone Meal	14	"WRIGHTS"	Wrights, Ltd.	Whale bone	8·5	....	....	1·0	27·0*	28·0*	....
Sterilized Bone Flour	20	TRI-CAL-OS	Davis Gelatine (Aust.) Pty., Ltd.	Bones	5·0	....	....	....	30·0*	....	Lime CaO 40%*
Sterilized Bone Grit	21	do.	do. do. do.	do.	5·0	....	....	....	30·0*	....	do. do
Bone Meal	38	"ANCHO"	Anchorage Butchers Pty. Ltd.	Waste meat products	23·63	2·44*	Trace	Trace	26·76*	....	Lime CaO 26·95
Do.	111	"W.A.M.E."	W.A. Meat Export Works	Selected bones	18·75	....	....	0·25	26·0*	....	Lime CaO 27·0
Do.	162	"WATSONS"	Watsons Foods Pty., Ltd.	Abattoir offal and bones	14·0	....	....	....	26·5*	....	Lime CaO 36·0
2.—*Oyster Flour.*											
Oyster Flour	40	"DEANS"	J. Deane & Son	Oyster, shell and lime	....	....	....	0·5	Trace	....	Lime CaO 50·0
Do.	154	"THOMAS"	W. Thomas & Co. (W.A.), Ltd.	Oyster, shell and lime	....	....	....	1·0	*Nil*	....	Lime CaO 42·0

Stock Food.	Reg. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis. Sodium Chloride (NaCl).	Phosphoric Acid (P_2O_5).	Lime (CaO).	Magnesia (MgO).	Iron (Fe).	Sulphur (S).	Iodine (Cu).	Copper (I).	Cobalt (Co).	Manganese (Mn).	Potassium (K).	Zinc (Zn).
					% (Max.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)
3.—*Mixed Stock Licks.*																
Denmark Cobalt Lick	2	"C.S.M.L."	Cuming Smith Mount Lyell	Limonite, sulphate of copper, salt	38·0	....	....	....	....	....	....	0·14	20·0 p.p.m.	....	(Limonite) 20·0	
Sheep Lick	17	"DAVID GRAYS"	David Gray & Co., Ltd.	Sodium chloride, trace elements, bone meal, yeast	80·0	1·0*	5·0*	....	1·2	3·3	150 p.p.m.	220 p.p.m.	92 p.p.m.	200 p.p.m.	50 p.p.m.	80 p.p.m.
Cattle Lick	18	do.	do. do.	Sodium chloride and various trace elements	80·0	1·0*	5·0*	....	1·2	3·3	150 p.p.m.	220 p.p.m.	92 p.p.m.	200 p.p.m.	50 p.p.m.	80 p.p.m.
Mineralized Supplement for Stock	22	"RAWLEIGHS"	The T. W. Rawleigh Co. Ltd.	Salt, sulphur, copperas, sodium phosphate, potassium iodide, calcium carbonate, cobalt sulphate, defluorinated phosphate, mineral oil, molasses and drug mixtures	15·0	12·24*	27·0*	Calcium (Ca) 13·42	1,000 p.p.m.	3·5*	220 p.p.m.		10 p.p.m.		80 p.p.m.	Sodium 70 p.p.m.
Poultry Powder Iodized	23	do.	do. do.	Oyster shell, sulphur, potassium iodide, copperas, iodine sulphate, ground bone, manganese sulphate, cobalt sulphate, zinc sulphate, quassin, defluorinated phosphate, mineral oils	16·5	38·7*	....	....	400 p.p.m.	4·0*	100 p.p.m.	40 p.p.m.	100 p.p.m.	120 p.p.m.	40 p.p.m.	100 p.p.m.

Rock Salt	43	"ELDERS"....	Elder Smith & Co., Ltd.	Sodium chloride marl	95·0	....	....	....	....	....	....	....	....	....	....	....
Tri-ca-phene "B"	49	"BLUE PETER"	Agricultural Products Co.	Phenothiazine, ground limestone, limonite, copper carbonate, cobalt sulphate, manganese oxide	1·0	....	32·0*	....	2·9*	Phenothiazine 19·0*		1,200* p.p.m.	224* p.p.m.	500* p.p.m.	....	....
Medicated Calcium	50	do.	do. do.	Ground limestone, limonite, copper carbonate, cobalt, sulphur, manganese oxide	1·0	....	45·0*	....	3·5*	....	....	1,500* p.p.m.	285* p.p.m.	600* p.p.m.	....	....
Medicated Salt Block "B"	51	do.	do. do.	Salt, ground limestone, limonite, copper, cobalt, sulphur, manganese	70·0	....	6·0*	....	1·5*	....	....	550* p.p.m.	95* p.p.m.	200* p.p.m.	....	....
Chic-a-vite	56	VITA-LICK	Goldsbrough Mort & Co., Ltd.	Bone flour, bone charcoal, ferrous sulphate, flowers of sulphur, sodium sulphate, gentian, cod liver oil, potassium iodide, meal from rice	....	20·2*	25·9*	....	1·7*	1·7*	....	Sodium Sulphate. 6·0*			....	....
Concentrated Cattle Lick	58	do.	do. do.	Bone flour, bone charcoal, sodium sulphate, flowers of sulphur, limonite, potassium iodide, copper sulphate, cobalt chloride	....	28·2*	36·1*	....	3·5*	0·45*	·034*	0·2*	·014*	....	....	....
Concentrated Cattle Lick "D"	59	do.	do. do.	Bone flour, bone charcoal, sodium sulphate, sulphur, limonite, potassium iodide	....	30·0*	38·75*	....	1·25*	2·0*	·017*	....	....	....	....	....
Concentrated "D" Cobaltised and Copperised	60	do.	do. do.	Bone flour, bone charcoal, sodium sulphate, limonite, potassium iodide, cobalt chloride, copper sulphate	....	30·0*	38·75*	....	1·25*	2·0*	·017*	0·2*	·014*	....	....	....
Concentrated "G"	61	do.	do. do.	Bone flour, bone charcoal, limonite, potassium iodide, flowers of sulphur	....	28·75*	37·0*	....	3·5*	2·0*	·017*	....	....	....	....	....
Concentrated "G" Cobaltised and Copperised	62	do.	do. do.	Bone flour, bone charcoal, limonite, potassium iodide, flowers of sulphur, copper sulphate, cobalt chloride	....	28·75*	37·0*	....	3·5*	2·0*	·017*	0·2*	·014*	....	....	....
Mineral Supplement for Pigs	63	"POR-CO-VITE"	do. do.	Bone flour, bone charcoal, sodium sulphate, flowers of sulphur, sodium chloride, limonite, calcium carbonate, copper sulphate, cobalt chloride, potassium iodide	14·0	19·14*	29·32*	....	0·62*	9·6*	·052*	1·0*	·003*	....	....	....
Mineral Food Supplement for Pigs	64	"WATKINS"	The J. R. Watkins Co.	Calcium carbonate, magnesium carbonate, dicalcic phosphate, bonechar, ferric oxide, ferrous sulphate, magnesium sulphate, ground sulphur, salt, mineral oil, granulated manganese oxide, cobalt sulphate, copper sulphate, zinc sulphate and potassium iodide	10·5	15·0*	33·8*	0·5*	1·1*	....	·0153*	·0129*	·01*	0·25*	....	·01*
Mineral Food Supplement	65	do.	do. do.	Dicalcic phosphate, rock phosphate, calcium, carbonate, Ferric oxide, magnesium sulphate, ferrous sulphate, sulphur, salt	9·0	15·5*	32·0*	0·7*	1·1*	....	·0176*	·0129*	·01*	·009*	....	·011*
Sheep Lick	107	"WESFARMERS"	Westralian Farmers Co-op., Ltd.	Bone meal, salt, yeast, iron sulphate, copper sulphate, cobalt chloride, manganese sulphate, potassium iodide, sulphur, zinc sulphate	80·0	1·0*	5·0*	....	1·2*	3·3*	150 p.p.m.	220 p.p.m.	92 p.p.m.	200 p.p.m.	50 p.p.m.	80 p.p.m.
Cattle Lick	108	do.	do. do.	do. do. do.	80·0	1·0*	5·0*	....	1·2*	3·3*	150 p.p.m.	220 p.p.m.	92 p.p.m.	200 p.p.m.	50 p.p.m.	80 p.p.m.

* Minimum.

Stock Food.	Reg. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis.											
					Sodium Chloride (NaCl).	Phosphoric Acid (P_2O_5).	Lime (CaO).	Magnesia (MgO).	Iron (Fe).	Sulphur (S).	Iodine (Cu).	Copper (I).	Cobalt (Co).	Manganese (Mn).	Potassium (K).	Zinc (Zn).
Mixed Stock Licks—continued.					% (Max.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)
Stock Conditioner	119	"LUFF'S BLUE LABEL"	Stam Products	Yeast, maize oil, meal, caramel, oil of aniseed, boric acid, thiommine hydrochloride, salts of iron, copper, manganese, zinc and cobalt	Vitamin "B_1" 29,700 1U/lb.			....	1,646 p.p.m.	Yeast. 1·78%		53·3 p.p.m.	49·6 p.p.m.	50·7 p.p.m.	....	56·4 p.p.m.
Phosphate Flour	155	"THOMAS"....	W. Thomas & Co. (W.A.), Ltd.	Ground rock phosphate	....	36·6*	42·0*	....	....	....	....	....	....	....	....	....
Cattle Lick	158	"BOVEX"	Chemex Products	Salt, rock phosphate, cobalt chloride, copper sulphate, manganese sulphate, iron and zinc oxide	75·0	4·0*	10·0*	....	0·78*	0·06*	....	0·06*	0·01*	0·05*	....	0·16*
Sheep Lick	159	"OVEX"	do.	do. do. do.	60·0	4·0*	10·0*	....	....	·10*	·78*	·06*	·075*	·06*	....	·20*
"G" Concentrated Sheep Lick	167	"VIC-LIC"	Wilcox Mofflin, Ltd.	Bone char, iron, limonite, potassium iodide, copper carbonate, cobalt chloride	1·0	28·0*	37·0*	....	5·8*	....	....	0·75*	·031*	....	....	....
Concentrated Cattle Lick	168	do.	do. do.	Bone char, iron, limonite, salt, potassium iodide	5·5	27·0*	36·0*	....	2·9*	....	....	....	....	....	....	....
"D" Concentrated Sheep Lick	169	do.	do. do.	Bone char, iron, limonite, sodium, sulphate, copper carbonate, cobalt chloride, potassium iodide	1·0	29·0*	38·0*	....	2·9*	....	....	0·75*	·031*	....	....	....
Mineralised Salt Block	170	do.	do. do.	Salt, pulverised limestone, iron, limonite, epsom salts, molasses, bone char, potassium iodide	53·0	4·5*	19·5*	0·16*	1·25*	....	Molasses. 3·0	....	....	....	....	....
V5 Vitamin Concentrate for Horses	184	DAY SON & HEWITT, LTD.	Boans, Ltd.	Vitamins "A," "B_2," "B_{12}," "D_3," "E_3"	Vitamin "A" 1,000 I.U.				Vitamin "D_3" 2,000 I.U.		Vitamin "B_2" 3 Mgm.			Vitamin "B_{12}" 8 Mgm. Vitamin "E" 10 Mgm.		

* Minimum.